ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXXXVIII. No. 3577. JUNE 14, 1946 9d. WEEKLY

Combustion Conditions

Adaptation of Boilers for Particular Fuels

IN the full exploitation of the nations' fuel resources, so that each industrial process requiring coal may the more readily obtain the type most appropriate to its needs, the value of the accommodating attitude of power-station engineers towards combustion can hardly be over estimated. For the generation of electricity almost any of the widely diversified kinds of coal found in this country can be burned with high efficiency. The tonnage used for this purpose amounts now to upwards of an eighth of the total mined, and there is thus a wide margin for the disposal of grades for which there is no other appreciable demand. This practice could probably be developed still further, subject to certain conditions.

Unsuitability Means Lower Efficiency

There is no real incompatibility between such a claim and the complaints that have been voiced in recent years about the inferior coal made available to power stations. The crux is that no single design of boiler plant can cope with every class of coal. "Unsuitable" would, perhaps, be a better description than "inferior," since the former term covers both the loss of plant capacity and efficiency, which accompanies the inclusion of abnormal proportions of ash, and the inherent inability of a boiler to operate with fuel the components and size of which differ greatly from those for which it was constructed. There is, for example, a big difference between a power station having mechanical stokers and combustion chambers suitable for dealing with high-volatile fuel and one having the pulverized fuel equipment which is necessary when the volatile constituents drop below about 10 per cent.

Moreover, different methods must be adopted to avoid atmospheric pollution. The first need is, therefore, to ensure delivery at the power station site, over a period approximating to the economic life of the boilers, of coal that shall be constant in quality (however mediocre) and of the type for which the plant was designed. Experience before the coming into effect of the Coal Mines Act of 1930 suggests that this should be quite possible. It would, moreover, simplify manufacturing as well as operating problems. The drawing up of a British Standard that will define size, quality and conditions of sale and also unify nomenclature as between different coalfields would be of great assistance in attaining this object.

Special Designs and Costs

While present-day power stations have generally been laid out with a view to making the most of readily available low-grade fuel, new stations might be designed to utilize types that were more especially a drug on the market, as is already done with anthracite duff at Tir John station, Swansea. Of nearly 5 million kW of generating plant required within the next three years or so, some 2 million kW will be in new stations and by the end of that period it seems probable that the existing stations will be extended to the limit of their site capacity, necessitating the building of further stations for all additional

growth of load. This trend should facilitate the adoption of a fuel policy on the lines indicated. Capital and running charges of plant constructed especially to burn waste fuel would no doubt be comparatively high. Continuance of the past tendency to penalize the consumers of electricity (such as by the diversion, before the war, of savings from technical advances to the collieries and, more recently, the imposition of flat-rate increases in price per ton irrespective of heat value) would defeat the object of encouraging the use of low-grade fuel. That can be achieved only by ensuring the delivery of coal at prices that take full account of the additional costs of burning it, its calorific value and unsuitability for any other market.

Co-operation with Contractors

ELECTRICITY supply undertakings vary in their attitude towards electrical contractors; they may be antagonistic, indifferent or co-operative. The possession of an installation department puts an undertaking into competition with the contractors, frequently to the latter's disadvantage. Where there is no installation department there can be no reason for antagonism or indifference; it is wholly in the interests of the undertaking and its consumers that there should be an understanding and, if possible, working arrangements. This is realized in many areas and we are glad to see that the idea of contractors' "circles" is being pursued again; that at Croydon has recently been revived and moves to this end are afoot in Cardiff and Gloucester, among other places.

A Concrete Example

THE way in which these circles can operate is seen from some notes supplied by Mr. G. V. Harrap, the borough electrical engineer of Gravesend. There the local contractors have a circle which holds monthly meetings, presided over by Mr. Harrap, at which such subjects as supplies of material, controls and priority arrangements are discussed. All inquiries and orders for installation work required by the Electricity Department are sent to the secretary of the circle who selects members of the circle to undertake the work. If a member is short of any items of equipment the secretary arranges to borrow them from other members so that work is not held up. In the wiring of houses on estates the contractors operate together as a body to ensure speedy execution of the work.

Degree Days

ESTIMATES of the number of kWh likely to be taken for warming a building over a period cannot be deduced with close enough accuracy by calculating the maximum B.Th.U. required to raise the external temperature to that needed for comfort. A practical criterion is, however, provided by the "degree-day" method, in which the difference in degrees between a prescribed internal temperature and mean external temperatures are multiplied by the number of days. Data received by us from the Northmet Co. clearly show that the considerable economies indicated from the adoption of this method, which (as described in our issue of March 19th, 1943) enables a continuous check to be kept on consumption, have been fully maintained during the past heating season.

Makers' Pamphlets

INDUSTRY generally is indebted to the Royal Institute of British Architects for initiating with the British Standards Institution the move for standardizing the size and "make up" of trade publications. These often contain much valuable information that is well worth its space in any engineering library, particularly if a high proportion of technical data is included. Chances of survival as works of reference are, however, jeopardized, if through its unusual dimensions a publication cannot easily be filed or take its place on a bookshelf with others. Avoidance of waste of effort and material in this way is the purpose of B.S. 1311: 1946.

Constant Resistivity

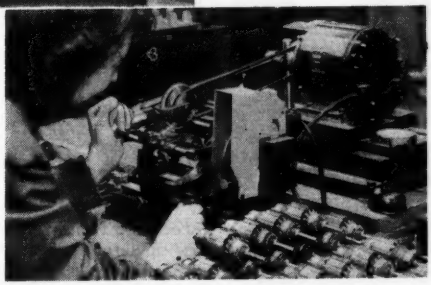
FOR many electrical purposes there is scope for conductors having a low temperature coefficient. So far as we can discover, no use has yet been made in this way of an alloy with a slightly negative temperature coefficient that has been specified for the construction of aircraft, but in that case on account of corrosion-resisting properties together with high tensile strength. Its composition is 43 to 48 per cent nickel, 21 to 25 per cent zinc and 2 per cent each (as a maximum) iron and manganese, the rest being copper. Its resistivity is given in C.D.A. publication No. 38 as 80 microhms per cubic centimetre.

Making Vacuum Cleaners

Production at a New Scottish Factory

A GOOD start in the resumption and expansion of its domestic electrical appliance production has been made by Vactric, Ltd., at its new factory at Chapelhall, Scotland. With no prospect of its bombed works at Cricklewood being restored, the company took over this factory about a year ago, and production is now well under way of the "W.100" cylindrical model and the "Junior" outside bag type vacuum cleaners. In addition, production of the floor polisher originally made in small quantities at Cricklewood has been transferred to Scotland. The portion of the Cricklewood premises previously used for the manufacture of the floor polisher will house the tool room and tool design office, in addition to the London Service Department.

General view of the Chapelhall works



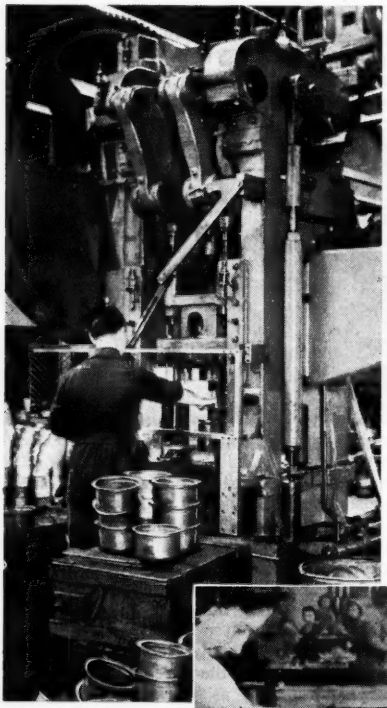
Above: Inserting coils into armatures. Right: Balancing armatures dynamically

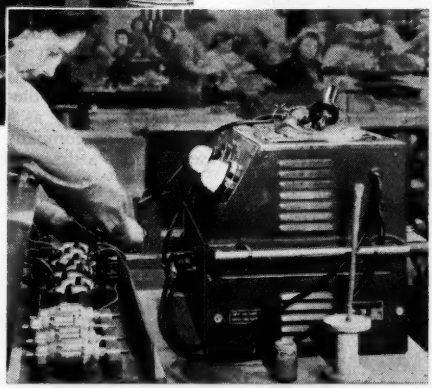
Early next year the first of three 200,000 sq ft sections of another new factory now being erected on the near-by Government industrial estate at Newhouse is expected to be in production of other domestic appliances, including irons, washing machines and ironing machines. Consideration is being given to the manufacture of further domestic appliances as soon as production of the standard lines is well under way.

Production at Chapelhall is planned on a greater scale than was possible at the former Cricklewood factory. A number of material supply difficulties are at present restricting output, but there is evidence that the planned output will be reached without difficulty, immediately the shortages are overcome. Half of the production is reserved for export, and, as we have already announced, the company has among its overseas orders a first order valued at £100,000 (with others to follow) for "W.100" machines for the United States.

The two models now being made have been selected out of the company's pre-war range numbering some sixty-odd models, as requiring the minimum of servicing and maintenance. Some minor changes in design have the same object in view. An all-steel

handle replaces the former plastic handle grip, removing the risk of breakage, and a new method of mounting the motor requires two screws only, thus reducing the time taken for assembly and facilitating servicing.





Above: Pressing out end domes of the cylindrical cleaner. Right: Armatures and field coils undergoing 1,000-V insulation flash test

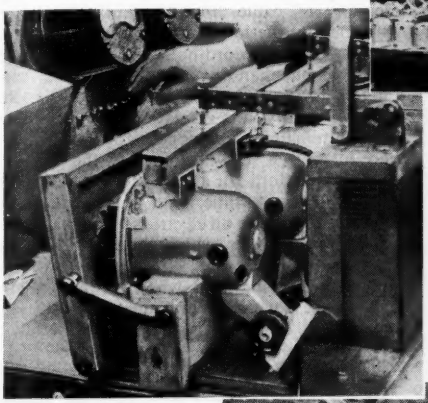
All tools and fixtures required in the manufacture of the cleaners are made on the premises, with the exception of bakelite moulds and die-casting dies which are made in the London tool room. In the machine shop automatic high-speed lathes are extensively employed for repetition production of such components as armature spindles, rotating brush pivots, carbon brush holders and caps, contact pins for electric plugs, spacers, bushes, screws, etc. The end domes of the cylindrical model are produced on a 75-ton toggle press, the deep draw being formed in one operation. Subsequent operations are sizing, trimming and beading, the switch aperture at the side of the rear domes of the cleaner being pierced on a horn press.

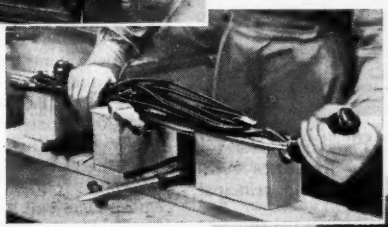
Such items as field coil retainers, hose ferrules, retaining cups, bearing covers, fans, etc., are also produced in the press shop. For the production of the aluminium-silicon alloy motor end frames, motor bodies, main nozzles, floor nozzles, etc., the most modern die-casting machines are being installed. What is claimed to be the largest die-casting machine to be used in this country has been obtained from America. By means of this, twelve different kinds of parts can be made simultaneously, all within 30 seconds. It is being used for producing motor parts, sleighs, main nozzles, elbows, motor mounting castings, fans and socket casings. A complete set of castings for either type of vacuum cleaner made by the company can be produced in one shot. The machine will take the place of twelve others now being used which produce one part each. Various ingenious jigs and fixtures have been designed to facilitate the drilling, tapping, machining and assembly of these and similar types of components. The machining and balancing of the "Junior" suction fans are other interesting operations carried out in the machine shop, all the machine tools in which, as elsewhere throughout the works, are of the individual drive type.

Line production has been adopted for assembly, the main assembly shop being equipped with five conveyor lines. Two of these exceed 130 ft in length, running between the raw material stores at one end and the dispatch department at the other. Inexperienced workers are trained actually on an assembly line. Most of the labour employed is from local sources, and the

greater proportion of that employed on assembly has been trained in the factory. This training has been facilitated by sending small groups of selected girls to the London works for a period of instruction. With suitable supervision, excellent results are being obtained, the girls generally being of a good type, and

Fitting fans on to motors





Above: Giving motors their first trial run. Right: Assembling handles of outside bag type cleaner

adaptable. In order to maintain a correct balance of operations on the lines, special attention is given to time and motion study, the timing of each operation and the position of the work tables relative to the speed of the conveyor belt (3 ft per min) being adjusted accordingly.

Coil winding for the motors is the first operation on the assembly line, those for the armatures, which are three section coils, being made on one side of the belt, and the field coils on the other side. After winding, the coils pass along the line where the flexible leads are attached; the coils are then taped and tested for continuity and short circuits before passing on for assembly into the armature and field cores. For these cores, gauges are used for selecting the correct number of laminations, those for the armature being pressed on the spindle under an air press, while the field laminations are subjected to pressure and machine riveted.

The commutator is also pressed on the armature spindle under an air press, a jig being used to ensure its correct angular position with the lamination slots, and, in this condition, the coils are inserted, after which the coil leads are stripped by means of rotating wire brushes, the bared leads grouped in correct sequence and inserted in slots in the commutator and then secured by caulking, the ends of the wire trimmed off, and the leads finally secured by solder dipping. This end of the armature is then bound with Hungarian twine so as to secure the leads against movement under centrifugal force, then further electrical tests are

Cutting out cloth for bags, several thicknesses at a time, by means of an electric cutter

made, such as that for reversed connections, followed by a 1,000-V insulation flash test. Any minor defects are rectified before inspectors permit the armatures to leave the line (together with the field assemblies, which have been made simultaneously on the other side of the line) for the impregnating process, which consists of pre-heating, dipping in special insulating varnish, subjection to vacuum and pressure, and finally baking. The commutators are then skimmed up, and the mica insulators undercut, and final

Final tests on the completed cylindrical type cleaner

dynamic balancing of the armatures completes the construction of the two principal motor components.

Commencing at the second main assembly line, where the "Junior" machines are completed, the fan and ball bearings are assembled to the armature shaft under carefully controlled pressure, the front motor plate being heated in an electric oven to a predetermined temperature before being placed over the outer race of the front bearing, which prevents damage to the accurately machined bore. The field assembly is inserted in the motor body, and the connections are made to the motor brush holders ; the armature and fan assembly is then inserted and secured to the motor body. The rear bearing cap, carbon brushes and rear wheels are fixed, and a short running test is made.

Proceeding along the conveyor, the main nozzle has the bayonet pins for securing the dust bag fitted, felt strips fitted to the bottom plate to ensure a good air seal, rubber buffer and front wheel carriage fixed, when the nozzle and motor body assemblies are brought together and secured, and the handle stirrup fitted. After checking, the machine is tested for consumption, air displacement, water lift (static head) and silent running.

At the end of this production line is a shorter line on which the handles are assembled, the operations being the insertion in the chromium-plated handle tubes of cut lengths of cable, the ends of which are stripped by the hot wire method, adding the switch, bakelite cord-holder, cord protector and bakelite handle plug, the cord and bag hooks having already been fixed to the handle tube. Finally an insulation test is made.

The remaining components of the cleaners are made in a separate block of the factory, where the cloth for the bags is cut, several thicknesses at a time, with an electric cloth cutter, stitched up on electric sewing machines and pressed, after which the stencil design is applied by the silk screen process. The revolving brushes and wheel assemblies are also made here, as well as the "W.100" fan assembles, on all of which resistance welding operations occur.

In an adjoining department are the electroplating and polishing sections, where the rough castings are scurfed and polished, and such items as handle tubes, handle fittings, and other metal parts are chromium plated. In addition to stage and final inspection, patrol inspection is continuously applied throughout the assembly lines.

Assembly of the cylindrical model, the "W.100," follows the same general procedure. The ball bearings are inserted in the machined front and rear motor end frames, the latter carrying the holders for the carbon brushes, after which the end frames are brought together with the field assembly and completed armature, and the fan unit is added. A running test is then made for consumption and static head. Although of quite different design, the air displacement of both types of cleaner is much the same.

Meanwhile, the cylinders, formed up from sheet metal and jig soldered, are covered with "Rexine," and the clamp rings, sleighs, handles and side clips fitted, and the nameplate attached, after which the motor and fan unit are assembled in the cylinder, the covers attached, the rear one carrying the switch unit, and a final running test given.

We thank Mr. H. Simms, M.B.E., production manager to the company, and Mr. A. T. Newman, chief designer, for their help in preparing this article.

Views on the News

Reflections on Current Topics

A DECISION of the Institute of Fuel to hold a pulverized fuel conference next May is in the nature of a corollary to an important recommendation in the recent Simon Report. In drawing attention to the very large resources of anthracite and dry steam coal that still exist, mainly in South Wales, the Report urged that steps should be taken to secure a steady and rapid increase in the output of these coals. As their low volatile content makes them especially suitable for pulverizing and electricity supply rightly claims to be able to absorb coals not needed for other industries, it is appropriate that power station engineers are strongly represented on the conference committee.

* * *

In welcoming Mr. A. G. Pargiter as a new member of the London and Home Counties J.E.A. at the Authority's monthly meeting last week, the chairman (Alderman Dudley Stuart, M.I.E.E.) referred to Mr. Pargiter's position as a Member of Parliament and hinted that the Authority was a school for future Cabinet ministers. Alderman Stuart recalled that Mr. Attlee (Prime Minister), Mr. Herbert Morrison (Lord President of the Council) and Mr. Chuter Ede (Home Secretary) had all been members in the past. Mr. Chuter Ede served a term as chairman and during that period was elected president of the Electrical Development Association. Mr. Morrison also had a good deal to do with E.D.A. when he was Minister of Transport in the second Labour Government. He was the principal guest at the E.D.A. annual dinner in 1930 and so far as I can recollect did not say a word about nationalization.

* * *

An official of the Birmingham Electric Supply Department, giving evidence at an inquest upon the victim of a bathroom fatality last week, said the the bowl fire which was the cause of the accident was fitted with a two-pin plug. He said that there was no statutory obligation for the use of three-pin plugs but his department always recommended them. There may seem to be a case for the compulsory use of three-pin plugs, but it is probable that this would result in more frequent accidents, for the amateurs who fix these things up could never be relied upon to use the right terminals.

* * *

One would have thought that the need for the utmost conservation of labour and material had not yet disappeared. It is therefore with some surprise that the announcement by the B.S.I. that its wartime code of wiring planning practice and the specifications accompanying it have now been cancelled. The surprise is tempered with a certain amount of satisfaction, however, for with the entry into the contracting industry of so many doubtful practitioners a reversion to the full rigour of the I.E.E. Regulations seems to be called for. Installations put in under these wartime arrangements are not expected to have so long a life as may be expected from "regulation" installations but I should be very surprised if, in most cases, any attempt will be made to replace them before they show signs of breaking down.

* * *

As the windows of all kinds of shops are now filled with electric fires, irons, kettles, etc., one finds it easy to believe the Board of Trade statement that in the first three months of this year the supply of household electrical goods to the Home market was 530 per cent above the volume for the first quarter of last year. Then most of the factories were still engaged in war work, but reconversion has proceeded so rapidly that now production is above the pre-war level. So much for quantity: quality is of course well below the pre-war standard in too many cases. The Board of Trade figures do not cover the important items cookers and water heaters.

* * *

Advertisements of the "Chimney Sweep and Electrical Contractor" type are a stock joke among installation engineers, but they are actually seen on occasions. On the same lines is a statement of objects in the registration of a new company which I was shown the other day. This concern proposes to "carry on the business of manufacturers of, and dealers in, household and domestic goods and appliances, cabinets, electric irons and radiators, refrigerators, and all kinds of electrical appliances, clothiers, hatters, boot and shoe dealers, dressmakers, etc." I am left wondering as to the significance of that "etc."

* * *

In an informative article on the Dalmarnock power station in a recent issue of the *Evening Citizen* (Glasgow) reference was made to the "friendly rivalry between substations and power stations, the substation men arguing that they refine the electricity, the power stations only make it." Yes, how could one use the crude thick stuff turned out by the generators?—**REFLECTOR.**

NEW BOOKS

Hot Water Systems. Varnished Cloth Insulation.

High Pressure Hot Water Heating Systems. By Frank H. Slade. Pp. 60; figs. 26; index. Princes Press, Ltd., 7, Princes Street, London, S.W.1. Price 5s. 6d. post free.

The author knows his subject well and provides ample data throughout this little book to help the reader reach his own conclusions. He commences quite early to show the advantages of high pressure hot water *vis-à-vis* steam for heating buildings and proves his case conclusively.

Although written primarily for the heating engineer, much of the data is applicable to electrical installations. The subject of boilers is not dealt with directly, otherwise one would look for some mention of this application of electricity.

The book does not err, as so many do, by ignoring the practical side of the subject; in fact the author shows evidence throughout the work of his practical experience, particularly in a section on "Plant Operation" in Chapter VI and in subsequent pages where boiler house efficiency is dealt with, but not as adequately as the subject deserves. There are two paragraphs devoted to " District Heating " which might well have been omitted as they contain very little more than a mere reference to the present trend in Europe and a plea for the high pressure hot water system to be used in future schemes. The book is one, however, which every chief engineer to an institution, such as a hospital, or any other large building, should have on his bookshelf.—P.H.

Varnished Cloths for Electrical Insulation. By H. W. Chatfield and J. H. Wreddon. Pp. 255; figs. 67. J. & A. Churchill, Ltd., 104, Gloucester Place, Portman Square, London. Price 21s.

This subject is usually covered by a few chapters in books dealing with the wider scope of electrical insulating materials in general. There are very few which are confined to this particular field, so that this volume will find a market which is necessarily limited. It caters more for those engaged in the manufacture of varnishes and varnished cloths than for the user, who, however, will find in it some useful information.

In a book of this title one would expect to find a chapter on the dielectric properties of varnished cloth, these finally being the reason for its usage. Actually the subject is included in thirty pages of the chapter on " Properties," in which the power factor of the cloth as used is not even mentioned. Breakdown voltage and insulation resistance appear to be the criteria and while they may be sufficient for many purposes, it is necessary to realize that the power factor of varnished cloth is of the order of 0·1 (or 10 per cent in the nomenclature used by the authors for oils, on p. 113), a figure which rules it out for much of the electrical industry.

One would like to see a separate chapter devoted to the examination of such properties as breakdown, resistance, power factor and specific inductive capacity, over a temperature range, and comparison made with other insulants. Such an investigation by the manufacturers might well lead to such an improvement that the market for this material would be greatly extended.

There is room for much work by an editor, as there is considerable overlapping between parts of the book. For example, the chapter on " Impregnating Varnishes " and the one on the " Manufacture of Varnished Cloth " contain much repetition, while " Storage of Varnished Cloth " on pages 85 and 86 is much the same as the remarks on ageing properties on pages 134 and 135. Proper editing would render the book more readable and make it a useful addition to the reference library.—W.C.B.

Sir William J. Larke Medal Competition. Pp. 156; figs. 142 and 40 drawings. Institute of Welding, 2, Buckingham Palace Gardens, London, S.W.1. Price 12s. 6d. (7s. 6d. to members).

This is a handsomely bound volume, printed on good quality paper. It comprises the five prizewinning papers of the forty-nine that were submitted to the examiners in 1944, all of them thoroughly practical. In the first the late Mr. H. W. Clark embodied specific details of railway constructional work, which the author had erected himself, mostly on the London Passenger Transport Board's system. The work described represents a considerable advance on anything that had been done previously and in design and execution is claimed to constitute a triumph for arc welding.

In the second paper Mr. R. Drucker deals with manipulators of objects to be welded, with special reference to a newly designed all-purpose faceplate type of 10 tons rated capacity. In the third paper Mr. P. Hastie describes procedure in the construction of large tanks, structural work, the prefabrication of ship parts as well as jig assembly and manipulators.

In the fourth paper Mr. J. R. Ferguson indicates how steel, prefabricated by welding, has been substituted for parts of marine engines that were always made of cast iron; this paper is chiefly concerned with the form of production control applied to this kind of work. In the last paper Mr. G. Foster deals with copper welding in the repair of steam locomotive fireboxes on the L.M.S. Railway system.—W.O.F.

Neutral Displacement—I

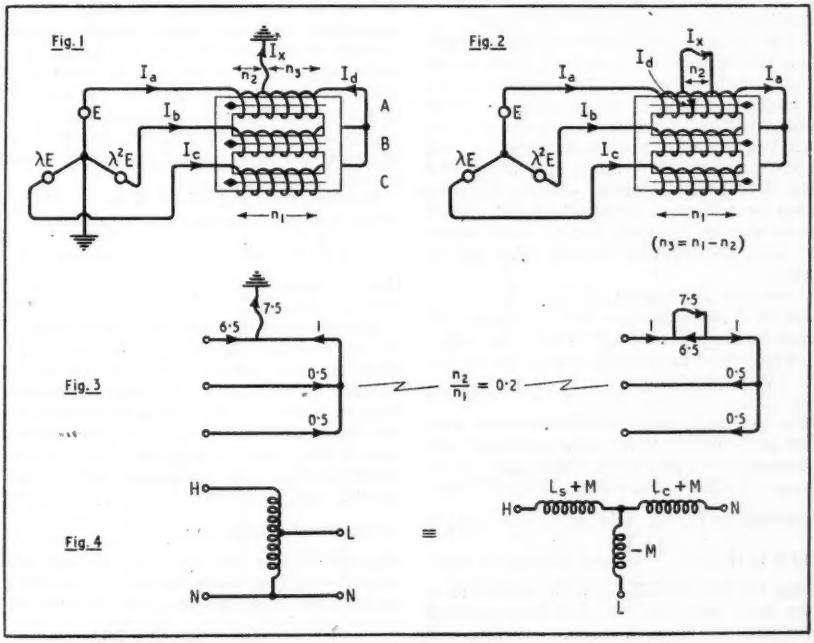
Values with Star-Connected Windings and Star/Star Transformers

By R. B. Rowson, B.Sc., A.M.I.E.E.

THOUGH the problem of neutral displacement has been dealt with quantitatively for cases where the impedances are not coupled and qualitatively in its more general aspects (e.g., see Gates, *I.E.E. Journal*, March, 1936), the writer has been unable to locate any reference to the quantitative evaluation of neutral displacement of transformers and magnetically coupled three-phase windings. The present investigations arose out of the overloading, through war-increased demand, of a voltage regulator through which an undertaking was supplied. A booster was transferred from another undertaking, but it had been purchased considerably earlier, before protection had become important. It had no conservator, nor could one be fitted at reasonable cost. Neither could a deflector plate be fitted, so Buchholz protection was out of the question.

The problem was, therefore, to find an alternative method having a sensitivity nearly as good as that of Buchholz protection. The first tests were carried out to ascertain whether frame-leakage protection would be suitable. By the courtesy of one of the T.M.A. firms, artificial faults were put on to a three-phase core-type unit. The leakage currents obtained showed that the method had possibilities, but protection was given only against frame or earth faults, whereas neutral displacement would also occur with inter-turn faults. During certain tests the neutral displacement was found to be sufficient to justify dropping frame leakage and concentrating on obtaining protection by neutral displacement or inversion.

In spite of the able assistance of two well-known scientific libraries and their staffs, no method of calculating the displacement to be expected for either of these types of fault could be found. The most generally available set



of figures are published in the "J. and P. Transformer Book," but current distribution only was considered during the tests described.

At this stage the engineers concerned with the day-to-day operation of the booster carried out a series of tests, the final one being a field test on the booster itself. The results obtained in this test are given in

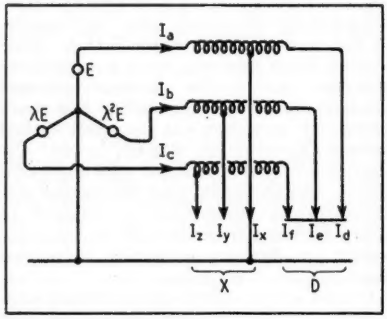


Fig. 5

Appendix A (second part of article) and show that the displacement is adequate to operate protective relays even when a very small section of the winding is short-circuited.

The relative magnitudes of the currents can be obtained by a method given in the *Brown Boveri Review*, March, 1939, p. 69. Referring to Fig. 1, which shows a three-phase winding on a three-legged core, one winding having an earth fault, then to a close approximation the voltage applied across legs A and B is unchanged whether there is a fault or not. As a consequence the ampere turns due to the fault current must equate to zero, and similarly for any other pair of legs.

Thus for legs B and C, $Ib \cdot n_1 - Ic \cdot n_1 = 0$, and for A and B, $Ia \cdot n_2 - Id \cdot n_3 - Ib \cdot n_1 = 0$, also, for the star point, $Ib + Ic - Id = 0$.

From these equations it can be shown that $\frac{Ix}{Id} = \frac{3\,(n_1)}{2\,(n_2)}$ and $Ib = Ic = \frac{Id}{2}$, thus indicating that the usual auto-transformer ratio does not apply directly to the ratio of primary and secondary currents under these fault conditions. Furthermore, the flux in leg A is proportional to $Ia \cdot n_2 - Id \cdot n_3 = \frac{Id \cdot n_1}{2}$, and in leg B to $Ib \cdot n_1 = \frac{Id \cdot n_1}{2}$ and similarly in leg C. Thus the flux in each leg is the same and in the same direction, i.e., is a zero-sequence flux returning through the case, windings and other paths. The e.m.f. induced per turn in each leg by this flux is the same; there is thus a zero-sequence voltage between earth and the star point of the windings, i.e., the neutral is displaced.

Fig. 2 illustrates the conditions for an inter-turn fault from which equations may be deduced yielding the ratios:—

$$\frac{Ix}{Ia} = \frac{3\,(n_1)}{2\,(n_2)} \text{ and } \frac{Id}{Ia} = \frac{3\,(n_1)}{2\,(n_2)} - 1.$$

Fig. 3 shows the relative magnitudes of the currents for both types of faults when 20 per cent of one of the windings is affected. Kidd* has pointed out that similar flux distributions occur when an auto-transformer is supplied on the lower-voltage side and suffers a phase-earth fault on the higher-voltage side.

Faults on the higher-voltage side of auto-transformers have also been investigated by Boyajian (A.I.E.E. 1930, p. 819), who has put forward the equivalent circuit shown in Fig. 4. Here the higher-voltage terminals are H and N, and the lower-voltage terminals L and N. In place of the transformer the unit is represented by a combination of impedances. Lc is the self-impedance of the section of the winding between L and N, Ls the self-impedance of the series section between H and L, whilst M is the mutual impedance between these sections, these symbols being used to avoid the longer, but more correct symbols such as Xcc and Xcs. This equivalent diagram is particularly useful in dealing with zero-sequence impedances and the resulting current distribution, but need not be evaluated for the positive-sequence values.

Working from Fig. 4, $Ls + Lc + 2M =$ the open circuit impedance H–N, i.e., $Z\phi_H$ ..(1)

$Ls - \left(\frac{M^2}{Lc}\right) =$ short-circuit impedance from the H side with terminals L–N short-circuited, i.e., Z_{HSC} .....(2)

Though relatively few tests are necessary in order to deduce the values for the equivalent diagram, the values must be extremely accurate to yield the short-circuit impedance from equation (2). It is preferable to measure this figure and the various component figures and fit them into the diagram. Should test results not be available one may assume that the self-impedance varies as the square of the turns. Thus Lc is approximately $\left(\frac{nc}{ns + nc}\right)^2 \times Z\phi_H$ and likewise with Ls. The corresponding zero-sequence quantities vary in the same manner, and if the zero-sequence open-circuit

* *Electrician*, Sept. 8th, 1944.

impedance is not known a figure of from 50 to 70 per cent will have to be assumed. Knowing Ls, Lc and $Z\phi_H$, M can be found from equation (1).

As a check, the figures obtained can be substituted in equation (2) and as a rough guide, born out by several tests, may yield a figure of about 100 per cent for Z_{HSC} when about 4 per cent of the windings are short-circuited. If the internal dimensions of the unit are known a value may be calculated by the methods set out in E.R.A. Report Q/T 103. Again, if the primary of a transformer is being considered, half the short-circuit impedance may be assumed to be due to the primary, and if this figure is multiplied by $\frac{nc + ns}{nc}$ a moderately close approximation of Z_{HSC} is given.

With the help of the equivalent diagram just discussed, a solution of the " winding-to-earth " fault case is obtainable by considering two simultaneous faults, because while under neutral inversion the voltage between the star point and earth is a zero-phase-sequence voltage, no zero-phase-sequence current can flow to such an isolated star point, as the impedance to such currents is infinite. As a consequence the usual equation of the form $V_3 = E_3 - I_3Z_3$ cannot be solved. In what follows the suffixes 1, 2 and 3 denote positive-, negative- and zero-sequence quantities respectively.

Referring to Fig. 5, we have three windings connected in star, there being an earth fault at X, whilst the star point has been considered as a phase-phase-phase fault at D. The star winding may be replaced by the equivalent diagram of Fig. 4, i.e., regarded as an auto-transformer fed on the H side and having a fault between H and N on one leg. To simplify the equations the impedance (Ls + M) is written as P, (Lc + M) as Q, and − M as R. On this basis one can draw the sequence networks shown in Fig. 6 and deduce the following equations:—

In respect of the earth fault at X, $Ix = I_1 + I_2 + I_3 \ldots (3)$, $I_1 = I_2 = I_3 \ldots (4)$ and $Vx = 0 = V_1 + V_2 + V_3 \ldots (5)$; while for the phase-phase-phase fault at D, $I_3 = 0 \ldots (6)$

Fig. 6

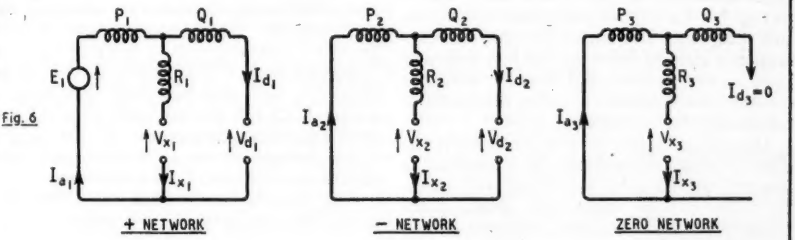


Fig. 7

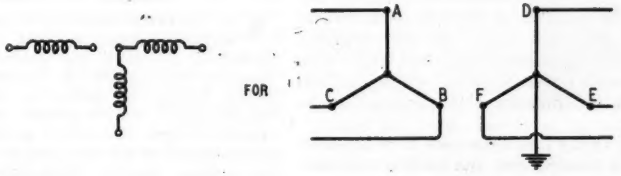
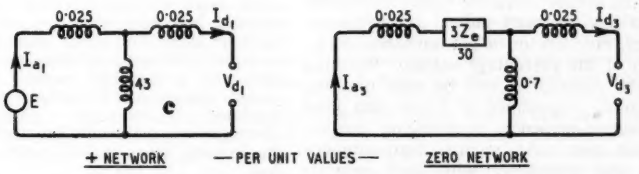


Fig. 8



and $V_1 = V_2 = 0$ ..... (7)

The networks of Fig. 6 give the following additional equations:—

$E_1 = Ix_1 (P_1 + R_1) + Id_1 P_1 + Vx_1$ ....(8)

$O = Ix_2 (P_2 + R_2) + Id_2 P_2 + Vx_2$ ....(9)

$O = Ix_3 (P_3 + R_3) + Id_3 P_3 + Vx_3$ .. (10)

$O = Id_1 Q_1 + Vd_1 - Ix_1 R_1 - Vx_1$ .. (11)

$O = Id_2 Q_2 + Vd_2 - Ix_2 R_2 - Vx_2$ .. (12)

From which,

$$Ix_1 = E_1 [Q_1/(P_1 + Q_1)] / [(P_1 + R_1) + (P_2 + R_2) + (P_3 + R_3) - \frac{P_1^2}{P_1 + Q_1} - \frac{P_2^2}{P_2 + Q_2}] \quad \ldots\ldots (13)$$

$Vd_3 = Ia_3 P_3 = Ix_1 P_3$ ..... (14)

These equations are somewhat complicated, and though the answers obtained by their use fitted in correctly with test results, no method of applying them to the inter-turn fault case suggested itself.

As test results for star-star transformers under asymmetrical faults were more readily available, attention was focused in this direction. It is known that a ϕ/E fault on the secondary results in a relatively small fault current and at the same time the neutral point on the h.v. side shifts (assuming it is insulated). The usual equivalent zero-sequence circuit has the discontinuity shown in Fig. 7. Thus if one calculates from the l.v. side (i.e., using Thevenin's theorem) no zero-sequence current flows in the h.v. side and thus, as the positive and negative sequence currents are balanced, there is no means of calculating the neutral displacement.

The difficulty can be overcome, however, if a hypothetical resistance or impedance is inserted between the star point and earth. Its value can be made very great, much higher than that of any voltmeter which may be inserted to measure the voltage sought. In the zero-sequence diagram this hypothetical resistance must be connected so that it does not affect the zero-sequence open-circuit impedance measured either from the secondary side (assumed to be earthed) or from the primary side (assumed to be isolated).

Using values based on tests on a 125-kVA core-type transformer, the positive and zero nets are as indicated in Fig. 8. The negative net, being similar as regards values to the positive net has not been shown. Impedances, voltages, etc., are on a per unit basis, i.e., 1/100th of the percentage values. Working from the diagram it will be seen that the short-circuit impedance is 5 per cent, and the positive-sequence magnetizing current 2·33 per cent. As regards zero-sequence values, the impedance with both neutrals earthed is 4·91 per cent and the magnetizing current 1·38 times full load. These figures are perhaps not quite representative as the tests were taken with the core removed from the tank, thus the impedance of the zero-sequence flux path would be unduly high.

For a short circuit of one leg of the secondary, the primary neutral being isolated, $Id_1 = E/(Z_1 + Z_2 + Z_3) = 1/(\cdot 05 + \cdot 05 + \cdot 725) = 1 \cdot 21$ per unit. Thus the primary fault current, $Ia_1 + Ia_2 = 2 \cdot 42$ per unit compared with 20 for a symmetrical fault or 20·1 for an earth fault with both neutrals earthed, the latter figure being on the low side for the reasons stated.

So far the calculations have followed previously expounded theory. It is, however, in calculating the neutral displacement that the hypothetical impedance, which has been given a value of 10 per unit, comes into play. From the diagram of the zero-sequence net, Ia_3 is $\frac{0 \cdot 7}{30 \cdot 725} \times Id_3$; thus the voltage drop over Ze is $\frac{0.7}{30 \cdot 725} \times Id_3 \times 30 = 0 \cdot 82$ per unit, i.e., approximately $0 \cdot 7 \times 1 \cdot 21$, or $Z\phi_3 \times Id_3$. Test results show a close agreement with this figure, and of the voltages between the other legs and the star point. V_B for example is $\lambda^2 - 0 \cdot 82 = (-0 \cdot 5 + j0 \cdot 866) - 0 \cdot 82 = 1 \cdot 58$ per unit compared with 1·57 obtained in one of the tests. It will also be noted that $Id/Ia = 3 \cdot 63/2 \cdot 42 \simeq 1 \cdot 5$, showing that, as in the case of the auto-transformer, the current ratio is 50 per cent greater than the turns ratio under certain asymmetrical fault conditions.

It is proposed to publish the concluding part of this article in our next issue.

Training of Welders

A STANDARD booklet of 32 pages illustrated with 14 sketches has been prepared in an endeavour to unify the general methods of assessing the quality of workmanship of a welder during his period of training. The booklet lays down the general requirements in respect of types of material, preparatory work, simulation of actual work and testing procedure for a series of tests. Two schedules list the various aspects of welds for which test specimens should be inspected. There are nine tests covering butt welds in plates and piping, fillet welds in plates and sheets, pipe branch welds and the building-up of surfaces. Appendices deal with a suggested method of preparing etched specimens and include notes for the guidance of instructors. Copies may be obtained from the British Standards Institution, 28, Victoria Street, S.W.1, price 3s. 6d., post free.

PERSONAL and SOCIAL

News of Men and Women of the Industry

AT its meeting on June 6th the London and Home Counties Joint Electricity Authority adopted the recommendation of its General Purposes Committee that **Mr. N. R. Elliott,** M.A., should be appointed general manager and chief engineer to the Authority. He will take up his new duties as chief executive officer of the J.E.A. in about three months' time.

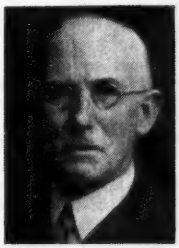
Mr. N. R. Elliott

Mr. Elliott is a barrister as well as a member of the Institution of Electrical Engineers and an associate member of the Institution of Civil Engineers. He was educated at St. Catherine's College, Cambridge, taking a tripos in both mechanical sciences and law. Beginning his career with Stephen Sellon & Partners, Westminster, he later served in the chief engineer's and managing director's departments of the London Underground Companies. He was then for a period with the London and Home Counties J.E.A., as personal assistant to Mr. F. W. Purse (whom he now succeeds), following which he held the post of commercial assistant to the late Mr. W. B. Woodhouse, managing director of the Yorkshire Electric Power Co. In 1936 he was appointed deputy engineer and manager of the Ilford Corporation Electricity Department and three years later succeeded the late Mr. C. F. McInnes as borough electrical engineer of Gravesend. In 1944 Mr. Elliott was appointed chief electrical engineer and manager at Wimbledon on the retirement of Mr. A. E. McKenzie, but before taking up his duties there he joined the Royal Engineers to carry out important work in France. He was later promoted colonel and appointed Deputy Director of Works, 21st Army Group. He has contributed articles to the *Electrical Review* on the subject of bulk supply charges.

At Wigan electricity works recently presentations were made to **Mr. R. Owen** on his retirement from the position of borough electrical engineer, and to Mrs. Owen who accompanied him. Mr. G. D. Kennan presided, and Mr. H. G. Winstanley (deputy electrical engineer) made a presentation from the staff, employees and friends. Mr. J. Derbyshire (mains engineer) presented Mrs. Owen with a hand-worked table cloth, and Mr. Gee (of Henley's) presented Mr. Owen with a pair of gold cuff links, and Mrs. Owen with a pair of book-ends. Tributes were paid to Mr. and Mrs. Owen by Mr. E. Howlett (B.T.H. Co.), and Mr. A. O. Johnson, who has succeeded Mr. Owen as borough electrical engineer at Wigan.

Professor Willis Jackson, D.Sc., D.Phil. (Oxford), M.I.E.E., who, as we reported in our May 31st issue, has been appointed to the University Chair of Electrical Engineering, London, tenable at the Imperial College of Science, as from October 1st next, received his education at Manchester and Oxford Universities, and was a college apprentice with the Metropolitan-Vickers Electrical Co., Ltd. He was appointed lecturer in electrical engineering at Bradford Technical College in 1926, and took up a similar post at the Manchester College of Technology in 1930. His next appointment was as research engineer with the Metropolitan-Vickers Electrical Co., Ltd., in 1936, and two years later he became Professor of Electrotechnics, Manchester University, which position he is relinquishing to take up his new appointment. Professor Willis Jackson is a member of the Council of the I.E.E., and chairman-elect of the Radio Section of the Institution. He is also a member of the Radio Research Board, the Executive Committee of the National Physical Laboratory, and of the Central Advisory Council for England of the Ministry of Education.

The most interesting item in the first list of the King's Birthday Honours published yesterday is the knighthood conferred upon **Dr. C. C. Paterson,** director of the General Electric Company's ResearchLaboratories. Knighthoods are also conferred upon **Dr. W. T. Griffiths,** chairman and managing director of the Mond Nickel Co., Ltd., and **Mr. H. L. Saunders,** Comptroller-General of the Patent Office. **Sir Donald Fergusson,** Permanent Secretary, Ministry of Fuel and Power, is made a G.C.B., and **Sir Raymond Birchall,** Director-General of the G.P.O. a K.C.B.



Dr. C. C. Paterson

At Electric House, Wallasey, on May 31st, a large gathering of the staff and employees of the Electricity Department bade farewell to **Mr. E. Cook,** the deputy electrical engineer and manager, on the occasion of his retirement after thirty-two years' service with the Department. Mr. R. C. Golding, chief electrical engineer and manager, paid tribute to Mr. Cook's work for the Department and on behalf of the members

of the staff and employees presented him with an extension loudspeaker. On their behalf, he wished Mr. Cook a long and happy retirement. Mr. B. T. Hawkins, former borough electrical engineer and manager, also spoke highly of the help Mr. Cook had given him while with the Department. The Electricity Committee at their last meeting passed a resolution thanking Mr. Cook for his long and efficient service. Mr. Cook has taken up residence in Meols.

The Norwich City Council has again increased the basic salary of the city electrical engineer (**Mr. J. A. Sumner**) by the sum of £200, raising it above the " Walker scale " figure.

Over 100 guests from the London area spent an enjoyable informal evening at a cocktail party given by Aberdare Cables, Ltd., at the Mayfair Hotel, London. **Sir George Usher,** chairman, Lady Usher and Mr. F. G. Penny, managing director, welcomed the guests, who included the Rt. Hon. G. H. Hall, Colonial Secretary, who is M.P. for Aberdare, where the company's main works are located. Executives of the associated companies, South Wales Switchgear, Ltd., and the Aberfren Cable & Construction Co., Ltd., were present.

Mr. J. Wilson Perry has been appointed a director of the John Thompson Engineering Co., Ltd.

Mr. A. H. Tombs has been appointed mains assistant with the Stafford Corporation Electricity Department.

Consequent upon the retirement of the chief mains superintendent, there has been a rearrangement of the Liverpool Corporation Electricity Supply Department's staff. **Mr. W. R. Willis**, senior district mains engineer, becomes chief mains superintendent, and **Mr. A. E. Elsworth,** district mains engineer, becomes senior district mains engineer. **Mr. H. Holden,** temporary assistant inspector, has been promoted to be district mains engineer. **Mr. C. F. Reid,** senior mains service engineer, is to retire on superannuation.

Mr. R. V. Darton has been elected chairman of the London Students' Section of the Institution of Electrical Engineers for the 1946-47 session.

Mr. W. J. Gibbons, power station superintendent at the Brighton Corporation electricity undertaking's Southwick Works, who is retiring after forty years' service, was the guest of his colleagues at a dinner given in his honour at the Savoy Café last week. Mr. H. Pryce-Jones, engineer and manager of the Brighton Electricity Department, presented him and Mrs. Gibbons with wallets of notes, a framed photograph of the staff and works, an illuminated address, a long-service certificate and a cake.

Mr. G. C. B. Everard, deputy electrical engineer to the Horsham Urban DistrictCouncil Electricity Department, has been appointed chief electrical engineer and manager in succession to the late Mr. F. Ffrench. Before going to Horsham he held appointments with the Hereford and Gloucester Electricity Departments.

Mr. R. K. Jenkins, A.M.I.E.E., borough electrical engineer of Redcar, has been appointed to succeed Mr. C. W. Emanuel, A.M.I.E.E., as borough electrical engineer of Workington at a salary of £800 per annum, plus cost-of-living bonus and car allowance.

Mr. W. J. Forster, deputy borough electrical engineer and manager, Walthamstow, has been appointed borough electrical engineer and manager at Wallasey in succession to Mr. R. C. Golding, who is shortly going to Southend.

Colonel R. M'Creary, O.B.E., M.C., general manager and engineer of the Belfast Corporation Transport Department, has been appointed a Knight Commander of the Order of Orange Nassau in recognition of his services in repairing and reconstructing the railway system in the Netherlands during 1944-45 when the country was liberated by the Allies.

Mr. Clerk, of the Motor Sales & Service Co., a subsidiary of E. A. Issa & Bros., Ltd., Kingston, Jamaica, is visiting this country to meet representatives of makers of cars, trucks and accessories, also electric motors, radio sets, electrical appliances, and components. His address is at the London offices of E. A. Issa & Bros., 197, Great Portland Street, W.1.

Monsieur Jean Vandenbempt is now in London, and will remain until June 20th to inquire into the possibilities of importing British electrical goods into Belgium. His address is c/o Credit Colonial and Commercial, British Columbia House, 3, Regent Street, London, S.W.

Mr. W. H. Ellerker, Associate I.E.E., showroom and hiring superintendent with West Hartlepool Corporation Electricity Department, has resigned.

Mr. George Stuart Wood and **Mr. Rawson F. Stagg** have been appointed local directors of Thos. W. Ward, Ltd.

Two North of England district managers of Hoover, Ltd., retired last month. They are **Mr. F. Dickie** of Liverpool, with twenty-four years' service, and **Mr. W. Faraday** of Blackpool, whose retirement after twenty-two years was caused by ill-health. Tributes to their work were paid at local functions when presentations were made to them.

Mr. Sydney Player has been appointed chairman of E. H. Jones (Machine Tools), Ltd. **Mr. G. C. Hibbert,** general manager, and **Mr. Denis Player,** of the Newall Engineering Co., Ltd., also become directors. **Mr. P. E. Verrall** has been appointed assistant general manager.

Mr. J. Fry, founder of Fry's Metal Foundries, Ltd., recently celebrated his seventieth birthday, and to mark the occasion he has been presented by the staff and workpeople of the company with his portrait in oils, painted by M. Francis Hodge, R.O.I.

The Engineering Golfing Society held its first meeting since the war at Worthing on May 25th and 26th. Amongst the various trophies competed for was the Hunter-Twiss Challenge Cup which was won by **Mr. H. Nielsen** of the General Electric Co., Ltd., in partnership with **Mr. J. W. J. Townley,** electrical engineer and manager, West Ham.

Mr. F. A. Vaughan, a director of British Oil Engines (Export), Ltd., is returning to India after a stay of several weeks in England for discussions concerning the development of his company's business in India.

Mr. John E. Ferguson, managing director of James Ferguson & Sons, Ltd., is the owner of Airborne, winner of the Derby Stakes at Epsom last week.

Obituary

Alderman Richard Mayne, of Heaton, Newcastle-on-Tyne, who was chairman of Newcastle-on-Tyne Transport and Electricity Committee for twenty-nine years until his retirement two years ago, has died at the age of eighty-six. He joined the City Council in 1904, becoming an alderman in 1920. He played a prominent part in the development of the city's tramways system and in the change-over to trolley and motor buses. In 1921-22 he was president of the Municipal Tramways Association, and in 1940 he was granted the honorary freedom of the City of Newcastle.

Mr. R. A. Parish.—The death occurred on May 31st at his home in Harborne, Birmingham, of Mr. R. A. Parish, who was sixty-one years of age. Mr. Parish had been associated with the Shropshire, Worcestershire and Staffordshire Electric Power Co. for forty-eight years, and at the time of his death was chief stores and wages officer.

Mr. Henry O'Halloran, Regional Controller, London and South-Eastern Region, Ministry of Fuel and Power, died on June 8th at the age of fifty-five.

Wills.—**Sir William Noble,** chief engineer, General Post Office, left £47,512.

Mr. P. G. Hobbs, electrical engineer, left £3,596.

Power Station Staff Training

Ministry of Fuel Assistance

DURING the war many operators were admitted to power station shift and operating staffs without sufficient training or previous experience, with detrimental effect on the efficiency and availability of plant. In normal times the method often adopted in the recruiting of operators was to upgrade men who commenced as labourers, either because they gave indications of being willing workers or because it was necessary to fill a vacancy quickly.

To improve the situation the Ministry of Fuel and Power offers to provide experienced lecturers for any boiler installation staff, and a correspondent has sent us some notes on the methods employed from experience in his own undertaking. First there was a series of informal chats between the lecturer and the shift staff of the boiler and turbine houses, charge engineers and control engineers, and maintenance and boiler cleaning staff. The courses arranged each consisted of a period of two hours on three consecutive afternoons, and overtime was paid for this time. The talks covered the design of boilers; reasons for different types of arches; draught and fans; CO_2; thickness of fires; effects of load changes; maintenance of efficiency by intelligent sootblowing and boiler cleaning; effect of sensible and considered operation on maintenance—especially in charging steam and water mains; results of full co-operation between control room, turbine house and boiler house in the operation of the boilers; and the importance of working a power station staff as a team and not in watertight departments. Questions were invited from the operatives.

As a finale to the talks the Ministry is arranging to show at the local Technical School the Babcock & Wilcox film "Steam" and several of its own films. This show will also be attended by the pupils of the Technical School.

The talks by the Ministry lecturers are the preliminary to a regular course of instruction for all operatives to be given by the technical staff on spare duties, and will form the basis of all promotions within the station.

Slag-metal Investigations

SLAG-METAL reactions in steelmaking do not appear to have been investigated on a laboratory scale in this country. A new method of melting slags and metal together at controlled temperatures to enable satisfactory samples of both to be obtained for testing is described by DRS. K. BALAJIVA, A. G. QUARRELL and P. VAJRAGUPTA (Sheffield University) in paper No. 34/1946 (Ingot Committee) of the Iron and Steel Institute.

The failure of most experimental arrangements is said to be due to the melting crucible being hotter outside than inside, so that the temperature gradient favours slag penetration of the refractory. The assembly of the arc furnace employed by the authors, the regulation of its temperature by variable input choke and the kind of thermocouples used for continuous recording are all described. The results obtained indicate that the empirical relationships previously utilized for industrial slag control break down when applied to slags of a wide range of composition.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

Unsafe Installations

THE three fatalities reported in your issue of April 26th have apparently created considerable criticism calling for support and condemnation of bodies both directly and indirectly responsible.

In my experience of installation work in many parts of the country, however, I have yet to find a supply company that insisted on an earth continuity test, which is in my opinion the most important test of all. Let supply companies be just a little less concerned with selling electricity and a little more particular with its tests and periodic inspections of installations for shoddy extra work and the first step toward "safe" installations has been taken.

Loughborough. N. DAVIES.

Nationalized Distribution of Electricity

DIFFERENCES in the distribution of coal and of electricity are so many, and the similarities so few, that it is not easy to see that Mr. Selwyn S. Grant made any such point of argument as suggested by you in your leaderette. In fact, reading the report of Mr. Grant's speech, this particular mention was not taken seriously. Perhaps he intended it to be taken facetiously!

The importance of the personal touch is admitted. "On the spot" decisions will, however, be just as possible under nationalization as in certain areas in the past, where rigid, if not frigid, control has been from a remote head office. Terms of new supplies should at least be clearly defined under the new control, whereas under methods adopted by some holding companies, the men in the field have not been able to give decisions even on the rates applicable to simple short extensions, but have had first to refer to head office to ascertain the contribution, guarantee and minimum kilowatt charge before being able to give any satisfactory reply to a prospective consumer.

I, personally, do not think engineers and administrators need fear, in many cases, any more shackling in the future than they have experienced in the past.

Minehead. W. D. BATES.

Codes of Practice

Lighting and Private Power Plant

THE provision of electric lighting in dwellings is the subject of a draft British Standard Code of Practice (3.4131) which has been issued by the British Standards Institution. It is the work of a panel (chairman, Mr. W. J. Jones) of the Code Committee convened by the Institution of Electrical Engineers. Its recommendations include those relating to the minimum foot-candles needed for various purposes, allowing a depreciation factor of 1·4, the wattage of pearl tungsten lamps (with a reference to the alternative of fluorescent lighting) and suitable types and luminous efficiency of fittings. The last named should be not less than 60 per cent, and the maximum brightness at any angle of view between horizontal and 30 deg below it should preferably not exceed two candles per sq in. and in no case should exceed 10 candles per sq in. A chart is given to enable the wattage of lamps required for fixed positions in living rooms of different areas to be readily obtained. Permissible weights of suspended fittings and the requisites for portable fittings and connections are given with the minimum numbers of socket outlets for lighting that should be installed in rooms, apart from those needed for other appliances. Observations are made regarding the relationship between illumination and decorative aspects.

Another Code (3.4101) of the same Committee (panel chairman, Mr. W. Riggs) covers private generating plant not exceeding 250 kW and 650 V and employing steam or internal-combustion engines. The adoption of an automatic a.c. system of standard voltage and frequency is recommended, provision being made for eventual change-over to public supply and also for load-factor improvement. Location of the plant, fire risk, foundations, housing and ventilation, protective systems, measuring instruments and batteries are among the other items dealt with.

A third Code of Practice (2.4), the work of a Committee convened by the Royal Institute of British Architects, has as its subject decoration-painting.

Comments on these draft Codes received by July 1st will be examined by the Codes of Practice Committee formed under the ægis of the Ministry of Works.

Applications for Employment

Some Hints on Answering Advertisements

By D. Williams, *M.Sc., A.Inst.P.*

NOW that industries are being removed from the scope of Essential Work Orders, workers have an opportunity of ensuring that their peace-time jobs are suited to their capabilities. The majority will, no doubt, be quite content to "stay put," but for those who desire a change the opportunity has arrived and industry as a whole will benefit by the transfer of its square pegs to square holes.

The purpose of this article is to assist those who have decided to seek another situation and are contemplating answering advertisements. Having recently dealt with a number of postal applications for positions, I am convinced that many capable people throw away their chances simply because their applications fail to convince their prospective employers that it is worth while inviting them to appear for an interview. It does not follow that the person who submits the most striking application is the most suitable person for the job, and no experienced employer would make such an assumption, but neither could he be expected to pay particular attention to the worst applications in the hope of finding hidden talent.

Recognized Qualifications

In looking through a number of letters from applicants perhaps the most striking feature is the fact that many of the writers are either born optimists or have not read the advertisement properly. For most situations there are recognized qualifications and experience and unless the application supplies evidence of these it is useless. You cannot become an engineer simply by calling yourself by that name.

The exact form which your application takes is not particularly important. If your handwriting is difficult to read it may be advisable to have the application typed but if so, make a good job of it. Even poor calligraphy is preferable to bad typewriting. Avoid also laborious efforts to produce "nice" writing as this is a waste of effort and may even be taken to indicate a tendency to pay too much attention to non-essentials. One further point: if you normally use brightly coloured ink remember that other people may not be impressed by it.

Far more important than the neatness of your handwriting is the general layout of your application. Adequate spacing, good margins and horizontal lines involve no extra labour but they do help to make a letter look attractive. If you are not sure about your English ask someone to correct the grammar and spelling. It may not matter very much so far as the job is concerned whether you can spell correctly or not, but a well-educated person reading the application may be irritated by your errors and also by your lack of initiative in failing to consult a dictionary.

Factual Information

Visual appeal should ensure that your letter receives consideration but beyond that its effectiveness depends upon the information which it contains. It is consequently important to supply full details of your qualifications without finishing up with a long rambling statement which some busy executive may not have time to read properly. Probably the best way of overcoming this difficulty is to tabulate all factual information on a separate sheet to which is attached a short letter stating your reasons for applying for the post and stressing any special qualifications or experience. If you apply for a number of jobs you will find this method much easier than trying to incorporate all the details in a number of special letters for each job. The tabulated list will, if sufficiently general, be suitable for all the applications.

What information does an employer require? Full details of your present post should be given if you are applying for a similar position. Previous experience and war service should be given in chronological order together with details of any special courses of study or examinations passed. It is advisable to state the notice required to terminate your present employment and also details regarding age, whether married or single and the number of children. Copies of testimonials should not exceed three in number and on no account should original testimonials be sent. Names of two or three persons to whom you are well known and who will answer questions regarding your character, etc., can be included in addition to, or in place of, testimonials.

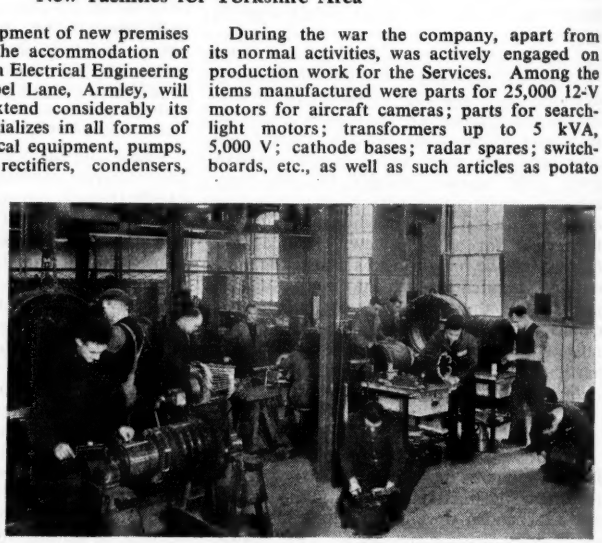
Some applicants hesitate to answer advertisements bearing box numbers in case the application goes to their own employer. The *Electrical Review* and some other journals overcome this difficulty by allowing applicants to place their replies in an envelope addressed to the paper and containing instructions for the enclosure not to be delivered to particular firms or individuals.

The art of writing a successful application lies in presenting as much relevant information as possible attractively and concisely. There is no point in explaining how good you are. Your prospective employer would rather decide that point for himself at an interview. He is interested in your qualifications which if properly set down will gain his attention. Make sure of that and you can confidently await an interview, when you can speak for yourself.

Motor Repairs

New Facilities for Yorkshire Area

WITH the recent equipment of new premises with three times the accommodation of its old works the Brandon Electrical Engineering Co. (Leeds), Ltd., Chapel Lane, Armley, will be in a position to extend considerably its repair facilities. It specializes in all forms of repairs to colliery electrical equipment, pumps, ventilating machinery, rectifiers, condensers, lighting and heating apparatus, collecting and delivering within a radius of about 60 miles of Leeds. Priority is given to breakdowns at collieries, etc. Motors up to 800 H.P. can be dealt with and the company is prepared to build up switchboards and similar apparatus.



A corner of the Brandon Electrical Co.'s new motor repair works

The new premises was originally a chapel with schoolrooms beneath. Apart from a few rooms arranged as offices, the whole of the first floor is used for winding small armatures, rotors, transformers, chokes, etc. Up-to-date coil-winding machines capable of dealing with every type of coil are provided, together with extensive test equipment.

Half of the ground floor is laid out as a machine shop to handle repairs to shafting, etc. This is equipped with lathes, drilling and tapping machines, power hack-saws, power presses, riveters, grinders, buffers, arc welding plant, etc. Separated from this department by dust screens is a section where the larger types of stators and rotors are wound. The remainder of the ground floor is occupied by vacuum impregnation and paint-spraying, a separate building housing trichlorethylene degreasing apparatus. After winding, the coils are flash-tested up to 8,000 V, H.P. tests also being carried out after re-winding.

During the war the company, apart from its normal activities, was actively engaged on production work for the Services. Among the items manufactured were parts for 25,000 12-V motors for aircraft cameras; parts for searchlight motors; transformers up to 5 kVA, 5,000 V; cathode bases; radar spares; switchboards, etc., as well as such articles as potato chip pans. A quarter of a million coils and chokes were also wound. All the jigs and tools used are made on the premises. Various types of sheet metal work are executed in a separate adjacent workshop.

The company runs its own training scheme, and its employees are encouraged to attend the technical school, being paid for time off to receive instruction. Wages, higher than the E.T.U. scale, are paid according to merit.

Steam Turbine Construction in Russia

It is announced from Moscow that the completion of the first high-pressure steam turbine at the Stalin Metal Works in Leningrad was celebrated on May 26th last. The machine is of 100,000 kW capacity and has been designed to run at 3,000 r.p.m. and to operate with steam at a pressure of 90 atm. and a temperature of 480-500 deg C.

Picture Transmission

Equipment and Methods Exhibited

AN exhibition of picture-telegraphy equipment, with samples of photographs, maps and printed documents transmitted thereby to indicate the excellence of the reproduction, was arranged in London last week by Muirhead & Co., Ltd. The transmitting and receiving instruments, which may be coupled by telephone land line, or radio link, are basically very similar, particularly mechanically, which simplifies their servicing and the provision of spare parts. Both machines are arranged for mounting on a table, or stand, while their associated electronic equipment is rack-mounted within sheet metal panels.

A conventional light-beam scanning system is employed, except for the step-by-step traverse that indexes the drum carriage forward in discrete steps, which are determined by an accurately cut ratchet. This reduces the number of gears needed in the system and is claimed to be largely responsible for the goodness of the scanning.

Both main Muirhead-Jarvis operating machines consist essentially of a cast metal basebed bearing a sliding carriage which contains the phonic motor for driving the drum round which the picture to be transmitted, or paper on which it is to be received, is wrapped. The optical portion of the instruments is fixed to a vertical bulkhead secured to the main casting. The light-beam chopper disc motor and photo-electric cell amplifier are also mounted on the bulkhead.

The transmitter drum is easily detachable for fitting the picture to be transmitted whereas the receiver drum is mounted in a light-tight box, which is removable from the machine, incorporating an exposure shutter operated by the closing of the instrument lid.

The drums are 10 in. long by 3·52 in. in diameter and 10⅜ in. useful circumference; they revolve at 1 or 2 revolutions per second. The speed change is effected by a switch on the rack, while one control on the traverse panel mechanism and another on the final light-ray aperture enable the scanning line width to be changed, respectively 0·01 and 0·0066 in. or 100 and 150 lines per inch.

The drum is floodlighted (7,200 c/s chopper-disc modulation) and sample selection is secured optically by means of an objective lens and a fixed aperture. The transmitted line signal is amplitude modulated, 1,300 c/s carrier within 300 to 2,300 c/s band.

The receiving optical system utilizes a Muirhead-Duddell oscillograph arranged to form an image of the mirror on the drum. Tone determination is by means of a reflected light beam moving over a shaped aperture.

Change-over panels on the indexing gear provide for right-hand or left-hand traverse of the drum, which is driven synchronously by a phonic motor and a d.c. assisting motor with single control switching to either of the two speeds of rotation. The system is synchronized by means of a 1,020 c/s tuning fork and the frequency may be varied by ± 200 parts in 10^6 by a calibrated control device.

A complete bench machine is 37 in. wide and 22 in. deep by 19 in. high, weighing 2·5 cwt, while its associated electronic cubicle is 41 in. wide and 18 in. deep by 83 in. high, weighing 5 cwt, energized from single-phase 50-c/s mains at 200/230 V.

A portable Muirhead-Belin transmitting set is assembled completely in a leather carrying case weighing 46 lb, being energized from a second case weighing rather less and containing a motor-generator set wound to take its input from a.c. or d.c. mains or a car battery.

Overhead-Line Poles

IN the House of Commons last week Major Digby asked the President of the Board of Trade, how many poles, complying with G.P.O. standards were held in stock by the G.P.O., or by any other department on its behalf, and how many had been ordered for the use of the G.P.O.; and if he would give similar figures for poles of equivalent quality available in this country to the electricity supply industry.

Mr. Belcher said that apart from poles issued but not yet erected, the number of which, of course, varied from day to day, the G.P.O. had about 140,000 poles in stock. The greater part of this stock was in sizes usable only by the G.P.O., and a considerable proportion was below the normal G.P.O. standard or had not yet been creosoted. No stocks were held by any other Department on behalf of the G.P.O. The only stocks held by the electricity supply industry were small day to day working stocks. Of the 96,000 poles expected to be available for use this year, 45,000 had been allocated to the Electricity Commission. The G.P.O. would receive 37,000 poles due in the second half of the year.

Major Digby asked the President of the Board of Trade whether he was satisfied, having regard to the importance of electricity supplies to the community, that sufficient priority was being given to the electricity supply industry in the allocation of poles, as compared with that accorded to the G.P.O.

Mr. Belcher said that the allocation of supplies for 1946 had been made in consultation with the Departments concerned, including the Electricity Commission, and had been accepted by them.

Electric Vehicle Association

Activities During the Past Year

IN the course of the report for 1945 of the Electric Vehicle Association of Great Britain, presented at the annual meeting on May 22nd, it is stated that one new member and three associate members were elected while one resigned. An advertising scheme was carried out in a number of trade journals, half of the cost being contributed by the British Electrical Development Association. A new booklet is being prepared for prospective purchasers of electric vehicles.

The Manufacturers' and Standardization Sub-Committee has recommended that manufacturers should aim at standardizing an arrangement of nine cells per container in electric vehicle batteries. Contact has been maintained with the Government Departments and during the year the Minister of Supply stated that licences granted for materials probably represented four times the pre-war annual output of electric vehicles. Ministry of Transport statistics show that in the years 1941-45 inclusive of the new registrations of electric vehicles were 351, 362, 316, 335, 370, most of them in the 12-20 cwt. and 1½-2 ton classes. The 1938 figure was 867. It is estimated that just over 7,000 vehicles were in use at Nov. 30th last (against 4,156 in November, 1938).

Hopes that the electric vehicle would come into its own upon the cessation of hostilities have not been fully realized owing to material and labour difficulties. It is confidently asserted that never before have there existed such opportunities for development.

The following officers were re-elected at the meeting:—President, Sir Felix Pole; chairman, Mr. A. W. Barham; vice-chairman, Mr. A. J. Fippard; and hon. treasurer, Mr. H. M. Drake.

New Film Studios

Details of the Electrical Installation

ON a site of 105 acres at Boreham Wood, Elstree, Herts, M.G.M. British Studios, Ltd., is building three studios for film production, each of 20,000 sq ft by 45 ft high and capable of subdivision; these are expected to be in action by the end of this year. A fourth studio will be added later.

Most of the electrical demand will be for lighting the studios where the use of colour on a large scale will call for an illumination intensity about three times that required for black and white photography. Air-conditioning plant on the plenum system will maintain the pressure in the studios slightly above that of the outside atmosphere and accidental admission of fog will be quickly coped with by extractors. In addition to the motive power required for special effects, there will be carpenters' and machine shops for building the sets and the mechanical devices needed on them and for maintenance work.

Electricity is taken from the Northmet Co. at 11 kV and for general purposes is stepped down to 400/230 V by two existing 500-kVA transformers. In the studios, however, d.c. is used for the arc lamps with a view to securing greater freedom from hum due to ripple in the supply and from variations in light intensity. In addition a smoothing system of laminated chokes and condensers will be installed in the outgoing d.c. feeders.

The d.c. supply comes via three B.E.T. 1,600-kVA 11/3·3-kV O.N. outdoor transformers fitted with off-circuit taps, conservators, double-float Buchholz relays, silica-gel breathers and 6-in. dial safe-load indicators. For controlling the 3·3-kV side of the transformers and the a.c. motors a nine-unit air-insulated horizontal draw-out truck-type cubicle switchboard with a certified rupturing capacity of 75 MVA is being installed. Solenoid operation of the motor feeder breakers is provided by rectifiers and a 30-V battery.

Converting plant comprises six 3·3-kV auto-synchronous motors, driving two 250-kW 120-V d.c. generators each and operating at unity power factor at all loads with automatic control. From the 20-panel d.c. switchboard will be taken three-wire overhead feeders of aluminium bar, three to every studio, two of them carrying 15,000 A each; the third, of 4,000 A capacity for services other than stage main illumination, will be supplied by a separate motor-generator, with its field controlled from the stage. A bare aluminium distributor will encircle each stage to feed eight centres with three-wire switchboards made up of one 2,000-A, four 400-A and two 30-A air circuit breakers and three remote-controlled 400-A contactors controlling sub-feeders.

The architects and consulting engineers are Guy Morgan and Partners, who are being advised technically by Mr. S. Moore of M.G.M., Culver City. The buildings are being constructed by Sir Robert McAlpine & Sons. The equipment here described was supplied by Crompton Parkinson & Co., Ltd. (which engineered and carried out the scheme) and the British Electric Transformer Co., Ltd.

Australian Import Restrictions

The *Board of Trade Journal* reports certain relaxations in the Australian Customs (Import Licensing) Regulations. A number of electrical and other components for use in motor vehicles and motor cycles are exempted from restrictions; they include dynamo-electric machines, voltage regulators, switches and cut-outs, regulating, starting and controlling apparatus, and electrical instruments. Among goods which are now subject to administrative control are refrigerating appliances and parts, other than cabinets, compressors, evaporators and sealed or semi-sealed units, not being replacement parts; electric stoves, ranges, cookers, etc., and elements (except enclosed type); and sparking plugs and parts.

COMMERCE and INDUSTRY

Grading of Meter Testers. Standard for Trade Literature

Employment in March

STATISTICS published by the Ministry of Labour show that in March last the number of people employed in the electrical engineering industry in Great Britain was 152,200 (50,600 women) as compared with 153,300 (52,300 women) in February, 175,800 (69,700 women) in mid-1945, and 133,900 (28,000 women) in mid-1939. Figures for the electrical wiring and contracting industry were as follows:—March 45,500 (5,400 women), February 44,300 (5,400), mid-1945 37,500 (5,500) and mid-1939 41,700 (2,800). In March 236,500 people (120,900 women) were employed in electrical apparatus, cable, etc., manufacturing, as compared with 236,900 (123,100) in February, 279,900 (167,700) in mid-1945 and 195,900 (79,500) in mid-1939.

At April 8th, 2,959 people (1,045 women) were registered as unemployed in the electrical engineering industry of the United Kingdom, 712 (79 women) in the electrical wiring and contracting industry and 3,622 (1,794 women) in the electrical apparatus, cable, lamps, etc., group.

Meter Testers

At a meeting of the National Joint Industrial Council for the Electricity Supply Industry held on May 23rd, the question of the rates to be paid to meter testers was reconsidered, and a resolution was adopted retaining the "Class 1 meter tester" as "meter tester," but abolishing the "Class 2 meter tester," establishing instead a new grade of "assistant meter tester" whose duties will be "to attend upon, prepare work for, and assist the meter tester, and to work under his direction." The rate for the assistant meter tester will be 2½d. per hour below that of a meter tester. This decision should operate from the commencement of the first full pay period following May 23rd.

Conditions in the Pottery Industry

In a letter to the local Press, Col. G. A. Wade, chairman of the Labour Committee of the Electro-Ceramic Advisory Production Committee, says that the recruitment drive for the electrical porcelain industry has not been abandoned, but the manufacturers thought it advisable to defer it until the general wage question is settled. When agreement has been reached they will continue their efforts to attract labour into the industry and hope to have the full support of the National Society of Pottery Workers.

Chemical Research Exhibition

A public exhibition at the Tea Centre, Lower Regent Street, London (June 5th to 28th) has been organized by Imperial Chemical Industries, Ltd., to illustrate eight outstanding wartime discoveries and developments in chemical research. One of the sections summarizes the history of "Perspex" with molecular models and samples of articles made from it. Chief interest in the polythene exhibit arises from the fact that its production by the polymerization of ethylene involves greater pressures than those used in any other industrial process. This substance is unique in being the simplest synthetic thermoplastic, composed of long molecular chains of 1,000 units or more, which may be a possible explanation of its remarkable electrical properties. These properties are illustrated by examples of its use as an insulating material for radar, television, radio, telephone and submarine cables.

Purchase Tax Guidance

Notice No. 77B issued by the Commissioners of Customs and Excise, City Gate House, 39-45, Finsbury Square, E.C.2, is based on provisions in the Finance Bill now before Parliament which will become operative as from June 1st. The whole of the notice applies to newly registered traders. Part A sets out the position with regard to goods which are the traders' property whether made by them or not. Part B, which also applies to traders already registered, deals with scheduled goods made by traders from other persons' materials. Part C covers such general matters as purchase of materials tax free, imports for process or use as materials, and cessation of business or change of address.

Manufacturers' Publications

Recommendations are made in a new British Standard regarding sizes and contents arrangements for Manufacturers' Trade and Technical Literature (1s. net from the British Standards Institution, 28, Victoria Street, S.W.1). While drawn up previously for the building trades, B.S.1311: 1946 is applicable to other industries also. The following page sizes are recommended: 11 by 8½ in.; 8½ by 5½ in.; 4 by 5½ in. The longest measurement should be from top to bottom and large sheets should be folded to conform to one of the standard sizes. Contents of publications should be arranged in a standard order under specified headings. All publications should be dated and each page numbered.

Change-over Compensation Decision

We recently reported that the Electricity Commissioners had ruled that the Barrow-in-Furness Corporation should pay compensation to a consumer whose radio set had been rendered useless by the change-over from D.C. to A.C. The Barrow Electricity Committee has accepted the ruling, but while admitting liability in this particular case has decided to decline to accept responsibility for apparatus which remained unnotified when notice was given of the change-over.

Chief Engineers' Salaries

At a meeting held in Birmingham on June 3rd the West Midlands District Joint Committee for Local Authorities and Chief Electrical Engineers was formally established. Sir Percival

Bower was appointed chairman and Mr. G. W. Clarkson, chief electrical engineer of Worcester, vice-chairman. There is a prospect of the early establishment of a similar Joint Committee for the Yorkshire District, which will complete the district organizations for England and Wales.

Woolwich Asks for "Price Ring" Inquiry

Woolwich Town Council has approved a recommendation of its General Purposes Committee that in view of the need for an abundant and cheap supply of electricity, the President of the Board of Trade and the Minister of Supply be requested to hold an inquiry into the operations of all producers' associations in the electrical industry and that (among others) Mr. G. Hicks and Mr. H. Berry, the M.Ps. for Woolwich, be asked to support that request. The Committee stated that over many years tenders received for electrical apparatus had shown evidence of price rings in action with central organizations deciding the prices to be quoted. In January, when the Council considered tenders for meters, all the firms which tendered were members of the British Electrical and Allied Manufacturers' Association, and the prices from each firm were identical.

Resignation of West Midlands J.E.A. Chairman

Following the revocation of his appointment as the West Bromwich Town Council's representative and the appointment of Councillor C. R. Kennedy in his place, Councillor J. Dyehouse has stated in a letter to the Council that he will be compelled to resign from his position as chairman of the Authority. He adds that "from statements made by certain members of the Labour Party, it is evident that they do not intend to allow any member of the Council who does not bear the Labour "tag" to hold any position of responsibility, irrespective of ability, experience or integrity." Councillor Dyehouse has resigned from the Town Council and Councillors Lees and Hardisty have also resigned from the Electricity Committee.

Visits to Stourport Power Station

On May 22nd a party of the S.W. & S. Electric Power Company's district managers' assistants visited the power station at Stourport as a part of a scheme for assisting staffs to keep in touch with the company's developments and activities.

About thirty members of the Redditch Branch of National Farmers' Union also inspected the station on May 31st. The visitors saw the progress which had been made with the "B" station which is expected to be in operation by the end of 1947.

Indian Mica

The Bombay correspondent of the *Chamber of Commerce Journal*, in a reference to the Mica Enquiry Committee set up by the Government of India, says that the Committee's report gives as the main objectives of the mica industry fairer prices for Indian exporters through scientific grading and marketing, the conservation of mica by the compulsory employment of proper mining methods, increased use of the mineral in indigenous industries and encouragement of the production of micanite and ground mica. A system of control of mining and marketing is recommended. Before the war over 70 per cent of the world's supply of sheet muscovite came from India; the output of dressed mica averaged between 140,000 to 185,000 cwt during 1940-43. During the war the Brazilian mica industry was stimulated for strategic reasons, but it is not possible to say whether this competition will persist.

Canada's External Trade

According to data recently released by the Canadian Bureau of Statistics regarding the external trade of the Dominion in the three months ended March last, exports of electrical apparatus then were valued at $5,682,000, of which radio apparatus represented $4,170,000, compared with $17,449,000 and $10,888,000, respectively, in the corresponding quarter of 1945. Imports were valued at $9,816,000, of which radio apparatus represented $2,589,000, compared with $11,840,000 and $4,879,000, respectively in January-March, 1945.

Works Visits

Mr. John Wilmot, Minister of Supply, recently toured the Foxhall Road, Ipswich, works of E. R. & F. Turner, Ltd., grain-milling machinery and electric motor manufacturers.

A visit was recently paid by members of the Association of Mining Electrical and Mechanical Engineers, South Midland Sub-Branch, to the works of the Brush Electrical Engineering Co., Ltd., at Loughborough.

New Philips Factory

Philips Lamps, Ltd., has acquired another factory in Northern England. This will be known as Philips Southport Works, Ltd., and will make special types of machinery connected with valve and lamp making processes. The directors of the new factory are Messrs. F. A. Kloppert, C. F. Cogswell and P. Stephenson.

Concrete Pole Manufacture

A factory is being established in Ulster for the manufacture of concrete poles to carry h.v. cables. A contract is being placed with the new factory by the Electricity Board for Northern Ireland for the supply of 1,500 concrete poles annually for three years.

Institute of Transport

Mr. R. Stuart Pilcher will deliver his presidential address to the Institute of Transport on October 14th. The annual meeting of the Institute will be held in London on December 20th. Functions arranged during the forthcoming session include the anniversary luncheon, which will take place on November 5th and the annual dinner which will be held on March 21st, 1947.

M.V. "Santander"

The electrical installation of the 7,000-ton cargo liner M.V. *Santander*, built for the Pacific Steam Navigation Co., Ltd., for its Pacific and South West America trade, by Harland & Wolff, Ltd., Belfast, includes three 350-kW, 220-V Diesel-driven generators, supplying power to

engine room, deck auxiliaries, galley and pantry equipment, ventilation, electric heating, gyro compass and lighting. There are fifty-four motors ranging from ¼ to 160 H.P. each, The cargo and warping winches, rudder, engine-room pumps, telephones, alarm and call bells, rudder indicator, revolution indicator and monitor alarm systems are all electrically operated. The galley and pantry electrical equipment has a loading of 97·5 kW. There are nearly 400 lighting points throughout the ship and a heating load of 180 kW. The keels of two similar ships are about to be laid.

Wartime Specifications Cancelled

In 1942, as a means of saving labour and material, the British Standards Institution published a Code of Practice for the Planning of Electric Wiring Installations (B.S.1062) and related specifications covering Wiring on Cleats (B.S.1063), Wiring in Conduit (B.S.1064), Outdoor Distribution Systems (low and medium voltage) (B.S.1065) and Bell and Alarm Systems (extra-low voltage or battery-operated) (B.S. 1066). The Institution has announced that these specifications and the code of practice have now been cancelled.

Blackburn Training Scheme

Mr. R. H. Harral, the Blackburn borough electrical engineer, reports that over fifty men, practically all ex-Servicemen, have been engaged under a scheme which he introduced for training men for technical posts in the electricity undertaking.

Women Engineering Workers' Wages

At a meeting in London last week between representatives of the Engineering Employers' Federation and the engineering trade unions (including the Electrical Trades Union) terms were agreed for submission to the National Arbitration Tribunal on the question of women's wages. It was recommended that there should be an increase of an amount to be determined by the Tribunal from the beginning of the pay week following May 6th, and that a joint committee should be set up to investigate the wage structure relating to women in the engineering industry. At an earlier stage of the negotiations the employers had offered an increase of 4s 6d per week.

Radar for Ships

The advantages and limitations of ship-borne radar are explained in a Ministry of Transport publication entitled "Radar for Merchant Ships," which is obtainable for 9d. from H.M. Stationery Office. It has been edited by Mr. L. S. Harley, head of the Central Radio Bureau, and contains an account of what a radar set is and does.

The characteristics of the set made by the Admiralty are explained in some detail, partly for defining the technical terms employed in navigational radar. Illustrations help one to appreciate the P.P.I. (plan position indicator) pictures formed by the received signal echoes. The most important sections are the two appendices, which contain a performance specification for a general-purpose set for marine use and auxiliary devices employed therewith. The Government hopes that the specification will be generally adopted by manufacturers, and the Ministry of Transport is arranging for makers to submit designs, or sets, to the Admiralty Signals Establishment for certification that they comply with required standards of performance.

Sussex Industries Exhibition

The Sussex Industries Exhibition which was held in Brighton recently was organized by the Sussex Engineers' and Manufacturers' Association, to give wide publicity to Sussex products,

The stand of Page & Miles, Ltd., at the recent Sussex Industries Exhibition

and was one of the first exhibitions to be held since the war. Page & Miles, Ltd., were the principal exhibitors of both domestic and commercial electrical and radio appliances, and displayed an interesting and comprehensive range of modern lighting fittings, heating appliances and refrigerators. Among the radio exhibits shown were modern Army equipment and the latest domestic receivers.

Reports on German Industry

The latest list of reports on German industry by teams of industrial experts who have made investigations includes the following, copies of which may be obtained from the Stationery Office at the prices shown, or consulted at public libraries, etc., in various parts of the country:—C.I.O.S.XXXI-37, Institutes of the Bevollmächtigter für Hochfrequenz-Forschung (High-frequency Research) (18s). B.I.O.S.297, Norddeutsche Seekabelwerke, Nordenhaus (1s 6d). B.I.O.S.467, German Secondary Battery Industry (2s). F.I.A.T.515, German Progress on Mechanical Rectifier or Contact Converter.

Water Heaters in Rural Areas

Mr. G. T. Allcock, chief engineer and manager of the Great Yarmouth Corporation Electricity Department, has sent us a copy of a brochure entitled "Electric Water Heaters" which is being circulated to all rural district councils, housing committees, architects, builders, electrical contractors, plumbers, etc., in the undertaking's 250-sq. mile rural area. Mr. Allcock feels that by "getting in on the ground floor"

of building development it may be possible to assist in making those responsible for houses electrically minded and so advance the cause of electric water heating. The advantages of the different types of apparatus for various situations are clearly set out, together with both capital and running costs. A similar booklet relating to the use of water heaters in the town area is also being prepared.

Philips Labour Campaign

An interesting experiment, designed to improve the rate of intake of women workers at the Mitcham works of Philips Lamps, Ltd., was recently carried out. By arrangement with the management of Streatham Locarno, a local dance hall, for one week an inquiry bureau was set up on the fringe of the dance floor bearing the slogan "What's it like at Philips?" A three-piece display was exhibited in the main entrance showing the advantages of working at the Mitcham factory. During each evening a "Canteen Cabaret" was given and Mr. H. Crossley, entertainment organizer of Philips works, explained that the show was part of a lunch-time entertainment given in the works canteen. Results of the experiment to date have been encouraging.

Darwen Engineer's Salary

Following reports of salaries paid in other towns, the Darwen Town Council has approved two increments of £50 each in the salary of its electrical engineer.

"Britain Can Make It" Exhibition

In connection with this exhibition, which is to be held in September, the organizers—the Council of Industrial Design—have completed arrangements for the selection of exhibits. This will be carried out by the selection committees at a Council collecting centre in London and the necessary instructions are being sent to would-be exhibitors on or about June 20th. Articles for the domestic electrical equipment section must be submitted by July 19th and radio apparatus by July 12th.

Future of Electricity Supply

"The Future of Electricity Supply" will be the subject of the talk by Mr. A. M. F. Palmer, M.P., at a meeting of the Combined London Sections of the Electrical Power Engineers' Association at Livingstone House, Broadway, S.W.1, on Monday next at 7 p.m.

Strike of English Electric Workers

Unless representations to the Ministry of Labour result in intervention more than 1,000 workers at English Electric Company's Preston factory are to join a token strike of Merseyside Engineering Workers called for June 17th.

Heated Roads to Prevent Snow Blocks

Mr. James F. McKellican, road surveyor to the Eastern Division of Perthshire, speaking at the annual meeting of the Institute of Municipal and County Engineers at Dundee, suggested road surface heating by electricity to prevent snow blocks and ice-bound roads. This, he said, could be carried out either by low-voltage methods, using a transformer and a bare resistance cable inset in the road's surface, or by ordinary mains voltage connected to a special soil-heating cable. Thermostatically controlled, the temperature could be raised to 40 deg F, which would ensure snow melting and prevent icing and skidding accidents. Snow clearing had cost his district £3,000 annually in the last few years. Heating circuits could be laid under an inch coat of asphalt at the rate of 500 circuits to the mile for approximately £1,000. Consumption per mile per hour would be about 600 kWh, costing about 4s.

Appliance Makers' Conference

The annual sales conference of Trustful Products, Ltd., was held recently at Palace Hotel, Southend, when the representatives were addressed by Mr. S. W. Fuller, sales director, Mr. J. Russon, managing director, and Mr. E. Charlwood, sales manager. The conference concluded with a dinner given by the directors.

Television Begins Again

After being shut down since September 1st, 1939, the British Broadcasting Corporation's television service was restarted last Friday. The first outside event was the Victory Parade on Saturday, "Emitron" cameras being placed opposite the saluting base in the Mall. It is estimated that over a quarter of a million people in the Greater London area were thus able to witness this memorable scene on about 15,000 television sets. Making this part of the day's television programme possible was the mobile recording and transmitting unit of three A.E.C. "Regal" vehicles built to the order of Marconi E.M.I. Television Co., Ltd., for the B.B.C. in 1937.

Fatalities

Shock from Shaving Mirror.—Charles Lionel Kayser (38), solicitor and temporary civil servant, of North Stoke, Oxfordshire, received a fatal shock from an electrically illuminated shaving mirror which was not properly earthed. At the inquest the coroner called attention to the danger of amateurs trying to wire electrical appliances themselves.

Faulty Switch.—At an inquest on Norman Trevor Whitley (31), of Preston, who was killed while repairing an electric iron at his home, it was stated that a faulty switch connection made it impossible for current passing to the iron to be cut off.

Trade Announcements

Unity Heating, Ltd., have moved to Chilworth Manor, near Southampton, Hants (telephone: Southampton 68844).

E. H. Jones (Machine Tools), Ltd., have acquired a factory in Halifax, Yorkshire, where it is proposed to build an extensive range of machine tools.

As from June 29th, the commercial branches of the Westinghouse Brake & Signal Co., Ltd., now at Chippenham, will return to the company's head office at 82, York Way, King's Cross, London, N.1 (telephone: Terminus 6432).

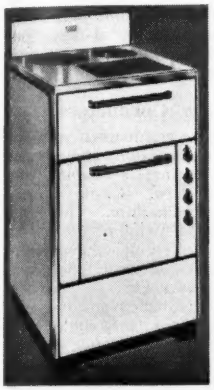
G. P. Dennis, Ltd., have transferred their factory from Chester to a new works at Fleming Road, Speke, Liverpool (telephone: Hunt's Cross 1217/8).

RECENT INTRODUCTIONS

Notes on New Electrical and Allied Products

New G.E.C. Cooker

THE GENERAL ELECTRIC CO.'s new domestic cooker, "DC.113," which will shortly be put on the market, is designed to take the place of a range of cookers. It occupies no more space than the pre-war small cooker yet it has oven and hob units adequate for the needs of any normal-sized family. Constructed of steel, the cooker weighs



G.E.C. "DC. 113" cooker

under 200 lb and has a smooth vitreous enamel finish. The standard model is mottled green, but a de luxe model will be available in white. The oven has a capacity of 2,700 cu in. and the warming cupboard 2,186 cu in. This cooker conforms to the E.D.A. specification for interchangeability of boiling plates and grill boilers and to the B.S. Specification 1195 which fixes overall dimensions of kitchen units at 21 in. square and 36 in. high.

Standard hob equipment includes two circular solid or radiant boiling plates 8 in. and 6½ in. in diameter and a grill boiler 10½ in. by 8 in. Loadings are 1,800, 1,000 and 2,000 W respectively. The 8-in. boiling plate is fitted with a six-heat switch providing three stages of simmer control. The oven has a drop-down door of special "three-panel" rigid design. The fall of the door is controlled by a patent braking arrangement and there is no risk of fracture as with a cast-iron door. "Ovenmaster" thermostatic control is standard equipment and the elements are dispersed to give the most even heat distribution. The tubular sheathed wire elements occupy the minimum oven space.

British Dry-shaver

It is announced by E. SIEGRIST, LTD., 39, Berners Street, London, W.1, that the electric dry-shaver known as the "Orel Baby," which is expected to become available in the early autumn, is now being made entirely in Britain, including the clipping head, which is made of steel. The shearing comb has teeth with bevelled upper edges for gripping the hairs while the sides of the teeth are sharpened for close cropping; the rounded ends of the teeth strengthen them and prevent irritation of the skin. One model is being made for from 110 to 250 V, in two ranges, varied by changing round the position of the base plug. The latter is removable so that the connecting flex may be rolled up for packing with the razor, which weighs 7¼ oz, in a leather purse of pocket size with zip fastener.

Relay Switch

A switching device, operated by a thermionic valve, which is suitable for relaying purposes, controlling the level concentration of liquids, limiting motion and gauging is announced by W. H. SANDERS, Bedwell Lane, Stevenage, Herts.

Actuation is by light contact of two fine wires or their short-circuiting by liquids or even moist materials. Thus any small input energy can, by valve amplification, be made to control heavy-current mechanisms. The device is entirely a.c. mains operated, the single valve being energized only when the control circuit is closed, so minimizing stand-by consumption. The valve is of an ordinary type and can easily be replaced, the whole device being in a metal case for outdoor or inside installation.

Metal Detector

A portable outfit for detecting buried metal, made after the style of Army land mine locators, is being marketed by CINEMA - TELEVISION, LTD., Worsley Bridge Road, Lower Sydenham, London, S.E.26. The apparatus, named "Cintel," is simple to use, there being only one switch and a single knob for adjustment. The search head is attached to a short handle and is capable of detecting, to within an inch or two, 6-in.

Method of using portable detector of buried metal

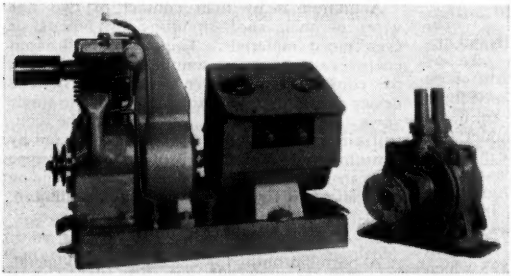
pipes and similar objects about 2 ft 6 in. below the surface of the ground. Even small pieces of metal concealed to a depth of 9 in. in timber may be

indicated by a distinctive note in the headphones. The amplifier and battery are in a weathertight wooden case which is normally carried over the shoulder by a leather strap, its weight being 6½ lb and overall dimensions 33¾ by 9⅜ by 11⅞ in. Cables, conduit and pipes buried down to 30 ft may be traced when a valve oscillator is connected for aiding the detector.

Utility Generating Sets

Post-war models of the miniature "Pygmylyte" generating set are shortly to be marketed by BRADBY'S ENGINEERING WORKS, LTD., Ditchling, Hassocks, Sussex, in sizes of 360 W at 20 V, 400 W at 24 V and 500 W at 32 V for driving such appliances as electric hedge trimmers and water pumps.

The four-stroke petrol engine with spark-plug ignition is of 104 cc capacity, consuming 0·67 pint of fuel per hour. The crankshaft is in ball bearings and an aluminium case; cooling is by a fan embodied in the flywheel with a cowl for directing the discharge of the air. The engine can be detached separately from the base, leaving the cowl, generator housing and wiring in position. The dynamo is directly coupled flexibly, an ammeter and cut-out being built into its housing, while starting can be by push button or wire rope flywheel spinner.



[Miniature "Pygmylyte" generating set with dynamo (centre) and pump (right)

Voltage Stabilizer

An improved stabilizer of a.c. mains voltage is announced by the WESTINGHOUSE BRAKE & SIGNAL CO., LTD., Pew Hill House, Chippenham, Wilts. Although the original "Stabilistor" operates on the magnetic saturation principle, a special circuit has been evolved to keep the wave form of the output voltage undistorted over a wide range of load, with the output held within fine limits in spite of simultaneous variations of both input voltage and load.

The new circuit consists of a double-wound transformer and an auto-transformer with their windings interconnected; across the output of the combination is a filter circuit composed of a condenser and choke in series, to perform a double action.

The values of the capacitance and inductance are so chosen that at 50 c/s the circuit behaves as a condenser drawing a leading current, which is necessary for stabilization, whereas at 150 c/s the circuit becomes resonant and acts as a low resistance for virtually short-circuiting the third harmonic magnetizing current of the auto-transformer. Thus the wave form of the resulting output should be virtually undistorted from one-quarter to full load. A refinement of purification of wave form by filtering out the harmonic content is to divide the condenser in the filter circuit into two parts, one part being resonated at the third harmonic as described, while the other, with a small additional choke, is resonated at the fifth harmonic.

High-Frequency Conductors

Cables and flexible conductors of the "Ashton" brand for television and similar high-frequency purposes are available from AERIALITE, LTD., Castle Works, Stalybridge, Cheshire. The aerial wire is made up of two 0·036 in. conductors in parallel embedded in polythene of $\frac{5}{16}$ in. overall diameter. There are two kinds of co-axial flexible cable. One type consists of a single 0·022 in. wire coated with polythene within the braided second conductor and sheathed with p.v.c. of $\frac{1}{4}$ in. diameter. Its capacity is 12 μF per ft and the attenuation is 6 db per 100 ft at 200 Mc/s, capable of being loaded to 80 W at 100 Mc/s. The other type has a 14-strand core of 0·0076 wires covered with rubber within the braided second conductor and a tough rubber sheath of $\frac{5}{16}$ in. diameter. The capacity in this case is 27 μF per ft and the attenuation 4·3 db per 100 ft at 45 Mc/s.

Convector Heaters

Convector air heaters constructed of sheet steel throughout are made by JOHN YUILLE (METAL WOOLS), LTD., Scottish Industrial Estate, North Hillington, Glasgow, S.W.2. They are finished in smooth bronze, ripple stove enamel in various colours, or metal sprayed, and are provided with hardwood feet, or a steel fender base.

The 1- and 2-kW "Hillington" models contain elements mounted horizontally on a steel chassis; the whole can be withdrawn in one piece by the release of two screws at each side of the casing. The chassis also carries "ventilator" ducting which directs the heated air out through the grille at the top front of the casing, a pilot lamp imparting a luminous effect. A half-heat kick switch is normally provided, or a thermostat; the latter may be combined with a double-pole switch. The 2-kW model is 22·5 in. high by 24 in. wide by 7 in. deep.

Process Analysis

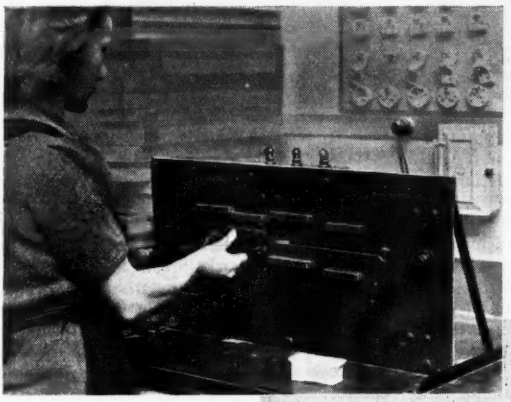
New Methods Adopted by M.E.M. for Training Personnel

NORMALLY the method adopted in factories to train new employees in repetition work is to show them how to do the whole operation slowly and then gradually speed up. At the Midland Electric Manufacturing Co.'s works at Tyseley, however, a new system has been successfully introduced whereby operatives are taught to work at the proper speed at the outset. The scheme aims at breaking down each process into its component parts and then showing the operator the way to do each part at correct speed.

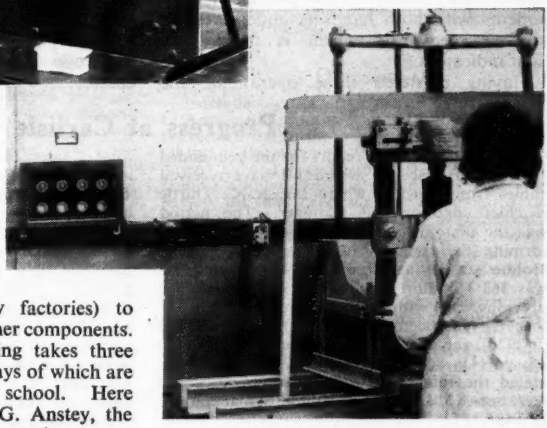
These new methods are proving specially successful in the highly-skilled process of porcelain manufacture and are of great assistance in enabling supplies of components of this material (a serious bottleneck in many factories) to keep in step with output of other components. The special course of training takes three weeks, the first week or ten days of which are spent in a special training school. Here under the direction of Mr. G. Anstey, the training supervisor, the new employees are enabled to get the correct "feel" of each individual operation by means of a series of ingenious devices. A quarter of an hour on each one is generally enough to prepare them for the "real thing."

The first of these devices, designed as a method of introduction to press, machine fettle and cleaning work, is a general jig fitted with lights which come on if the operator grips the dummy porcelain component too hard or if she deviates from the correct path. Judging the correct weight of moulding material for press work is assisted by the next device, and a special press is fitted with an indicator to show if the operations are carried out in the correct sequence. A guard on the press permits the handle to be swung round at the normal speed from the outset with complete safety.

Correct pressure for fettling is indicated by lights connected to the two sides of the band. Another device encourages the correct motion for polishing up the end portions of ceramic articles. To teach alternate motion by the two hands in cleaning out screw holes there is a board with a series of lamp indicators and also a buzzer to



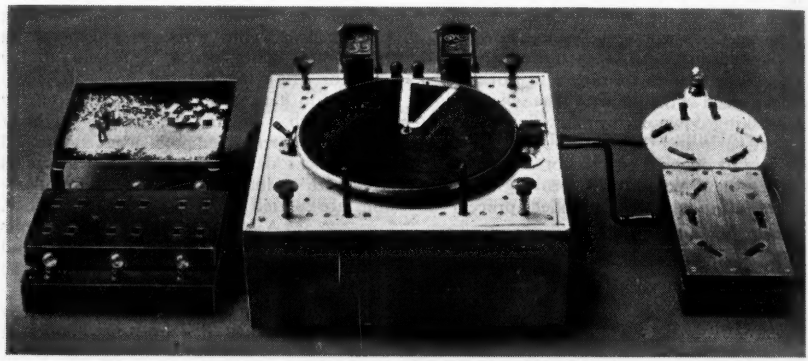
To learn how to grip and handle unfired porcelain components correctly the operator here has to manipulate a dummy component in the slot without touching the bars at top and bottom



The indicator on the left shows if the correct sequence of operations is followed on the press, the guard on which enables the handle to be swung round at normal speed from the outset

show if the pressure is too heavy. Cleaning out cavities round the edge of boxes, etc., is the subject of a similar device. Practice on inspection of components is provided by a special short conveyor. Then follows actual production work under supervision for a few days, after which the training is completed in the factory proper.

A similar training department for the trainee is given an actual production jig from the works so arranged that when all the components have been inserted correctly a light is switched on. For instruction in pressing and stamping operations, components have to be placed into slots of another revolving turntable. Final training before transfer to the factory production lines includes instruction in the use of automatic



Special devices employed in the main works training room for teaching dexterity, component placing, rhythm and location

company's main works has as its special aims dexterity, component placing, rhythm, location and assembly. A simple dexterity jig teaches the utilization of both hands, while a rhythm jig incorporating a gramophone turntable helps the operator to use both hands simultaneously. The placing of components with both hands is undertaken on another special jig which is fitted with light indicators.

Having mastered these operations, the screwdrivers which are employed extensively throughout the works. Incidentally study of the difficulties of operators in undertaking certain processes has frequently resulted in modification of works practice.

The company's personnel manager, Mr. V. J. Gosden, tells us forty girls are in training at present, including several who are being engaged for part-time work. About 300 have so far passed through the training centres.

Progress at Carlisle

THE first municipal report for the year ended March 31st last which we have received comes from Carlisle, where Mr. A. C. Thirtle is chief engineer and manager. The period was the first full year's operation of the plant forming the second extension of the Willow Holme station and the total kWh generated was 363·3 million (against 268·9 million in the previous year) with a fuel consumption of 1·337 lb per kWh generated (1·312 lb) costing 0·328d (0·292d), the average cost of fuel per ton being 45s 9d (41s 8d). Had the 1939 price still prevailed the total cost of fuel consumed would have been £314,500 lower than the actual amount of £496,577.

There was a reduction in supplies to factories and workshops in the city area, but all other classes of consumption were higher and the total sales (45·9 million kWh) showed an increase of 1·8 million kWh (4·3 per cent). The undertaking has an extensive rural area but the carrying out of extensions has been restricted by the difficulty of obtaining wood poles, while in two cases sanction for extensions has been held up by objections on amenity grounds. Cash and credit sales by the consumers' department totalled £15,564 against £5,522 and there is a long waiting list for cookers and water heaters. The hire schemes have not been resumed but a long-term hire-purchase scheme for the more expensive apparatus has been approved.

Revenue aggregated £261,527 (£249,030) and working costs were £199,245 (£186,728), the net profit being £2,448 (£4,050). The average price obtained per kWh sold was 1·366d.

ELECTRICITY SUPPLY

Proposed Margate and Broadstairs Board. Adelaide Petition.

Birkenhead.—CHANGE-OVER.—In connection with the Town Council's application for sanction to borrow £120,827 for the change-over from D.C. to A.C. the Electricity Commissioners have asked that a more limited scheme should be discussed in view of the present position with regard to the availability of materials.

Chester.—GRASS DRYING.—At a meeting of the Electricity Committee the electrical engineer reported upon the Buhler type of electrical grass drying machine developed and used in Switzerland. The Committee decided to inspect certain electrically equipped farms in Cheshire and Shropshire, particularly those possessing grass drying machines.

East Lincolnshire.—RURAL SUPPLY CONFERENCE.—Representatives of the Alford, Horncastle, Skegness, Spilsby and Woodhall Councils and a number of agricultural organizations were present at a conference convened by Commander J. W. Maitland, M.P., to discuss with the Mid-Lincolnshire Electric Supply Company the electrification of the rural areas of East Lincolnshire.

Liverpool.—LOAN.—The Corporation Electric Power and Lighting Committee is applying for sanction to borrow £258,250 for mains, plant and buildings, and also to use £50,000 from the reserve fund for temporary housing and change-over schemes, etc.

Margate and Broadstairs.—JOINT BOARD.—The Electricity Commissioners have submitted to the Minister of Fuel and Power for confirmation a Special Order for the purpose of constituting a joint board.

Nottingham.—WAITING LIST FOR APPARATUS.—Moving the adoption of the Electricity Committee's report at the last meeting of the City Council, Councillor F. Mitchell said that there was a waiting list on April 27th of 361 for the hire of cookers, 58 for the purchase of cookers, 2,010 for immersion heaters, and 173 for storage water heaters. The number of new supplies connected since August 1st, 1945, was 4,276. The Department had to wait four or five months for the delivery of electric cookers, after placing orders. There was a great demand for electrical equipment of all kinds in connection with housing programmes.

Application is being made for sanction to borrow £250,000 for mains and services, substations, meters, apparatus for hire, and assisted wiring.

South Shields.—JOINT BOARD PROPOSAL REJECTED.—The Town Council has decided against a proposal to set up a joint board to control the electricity undertakings in the area which was proposed at a recent conference of local councils held at Sunderland. The Council has approved an application for a twelve months' extension of the time allowed during which it has powers to purchase the electricity undertaking in its area.

West Hartlepool.—SUPPLY TO TRADING ESTATE.—The borough electrical engineer has reported on the question of supplying electricity to the new trading estate being established by North-Eastern Trading Estates, Ltd. The cost of making the supply available will be about £15,000, and it is suggested that as a first stage, electricity should be supplied to meet the needs of the first two factories at a cost of £3,374. Eventually it may be necessary to establish a bulk-supply substation on the estate.

Wimbledon. — HIGHER CHARGES. — The Borough Council last week decided to increase the charges for electricity.

The lighting flat rate is to be raised from 4d. to 4½d. per kWh and under the two-part tariff there is to be an increase of 1s. a quarter in the fixed charge while the running charge will be 0·7d. instead of 0·6d.

Councillor M. A. Bulloch, chairman of the Electricity Committee, said the chief reasons for the increase were that coal prices had doubled since 1940, and salaries and wages had increased by £7,800 during the year. It was estimated that there would be a deficit of £31,000 for the past year. Asked to state the profit for the preceding year, Councillor Bulloch replied that no figures had been published for three years, and when they were they would show a deficit for each year.

Councillor Lewis said it was disturbing to learn for the first time that there had been a deficit, and Councillor W. H. Thurlow declared that while there might be justification for increasing the charges it was not entirely due to the rise in wages. They were not told these things when the big pension was paid to the former electrical engineer.

Wolverhampton. — ELECTRICITY CHARGES. — The Town Council has referred back for further consideration a proposal by the Electricity Committee for a revision of tariffs applicable to lighting, heating and power.

York.—HIGHER CHARGES PROPOSED.—The Corporation Electricity Committee recommends tariff increases to meet the estimated deficiencies on the undertaking.

Overseas

Australia.—ADELAIDE COMPANY'S PETITION.—In April a Bill promoted by the South Australian Government for the acquisition of the undertaking of the Adelaide Electric Supply Co. was passed by one vote by the Legislative Council, after a similar Bill had been rejected. The passed Bill has been sent to London for the Royal Assent and the company has presented a petition for the withholding of the Assent. Among the company's contentions are that the Bill deprives the company of its property without compensation; that the provisions for the compensation of stockholders discriminate unfairly between South Australian holders and those outside the State; that the terms of compulsory acquisition are much less favourable than those provided by the Acts under which the company operates; and that some of the provisions of the Bill are beyond the competence of the South Australian Parliament in that they purport to alter the position under the company's memorandum of association and debenture stock trust deeds.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

The London Electric Wire Co. & Smiths, Ltd., held its annual meeting on June 5th when Mr. W. J. Terry (chairman and managing director), who presided, said that the balance sheet indicated a healthy financial position particularly from the point of view of liquid resources. The position of commodities had not improved since the cessation of hostilities. Copper and lead had been subject to increases because home prices were below world prices. Both these commodities were in short supply, particularly lead, and without an adequate supply of these and all other imported raw materials it would be impossible to retrieve this country's position in world markets. Bulk purchasing by Government departments was a handicap to progress. The world shortage of lead was likely to prove a severe handicap to the progress of the electrical industry which was a large consumer of this commodity.

The company's output during 1945 was lower not because of a slackening in the demand for its products, but entirely due to an inadequate supply of labour, particularly women. Orders outstanding on the books represented a large tonnage which was steadily increasing. Exports had increased during 1945 and could be considerably expanded up to and even beyond pre-war levels if both labour and material were in full supply.

Siemens Bros., & Co., Ltd.—A considerable fall in trading profit due to the change-over from wartime to peacetime production and to loss of labour is shown in the report for 1945. The profit was £290,888, as compared with £340,041 for 1944. The ordinary dividend is, however, maintained at 7½ per cent, and with a balance of £590,003 brought in the amount carried forward is £642,141.

The annual meeting of the company is being held to-day (Friday) and in a statement issued with the report and accounts, Dr. H. R. Wright (chairman and managing director) says that during the war the manufacture of telephone exchange plant both for home and export was restricted to the essentials needed for war purposes and there is thus leeway to be made up covering six years of normal extensions; moreover there is an increasing demand for the type of telephone exchange using automatic telephone switching principles. For private telephone equipment, both sales and rental, there is now a great demand. Whilst for the first half of the year the company continued to provide large quantities of telephone cables of many types for Service needs, the reduction and cancellation of contracts after the end of hostilities made it impossible in the second half of the year to keep more than a small portion of the plant occupied. However, with the clarification of the post-war requirements of the Post Office and Dominion telephone administrations the position has eased and the company can look forward to full occupation of its telephone cable plant provided the labour shortage can be remedied. The marine side shows a satisfactory turnover for the year and the demand for the company's equipment is increasing.

Since the end of the war considerable orders have been placed for power cables and the orders received during the full year greatly exceed those of previous years. Overseas trade showed a considerable increase on the cessation of hostilities and the demand for heavy communication equipment, wires and cables has been particularly heavy. The effect on production due to the cancellation of war orders and the change-over to peacetime production has been greatly accentuated by the acute labour shortage at the Woolwich works and it has been decided to move some of the production to places where suitable labour is available. A lease has been taken of a factory in the County of Durham and a factory in Yorkshire bought for one of the company's subsidiaries to which work hitherto carried out at Woolwich has been transferred. Both have been operating since the beginning of this year and when fully equipped will enable the company, at least in some branches of its business, to cope with the large demand for its goods.

Siemens Electric Lamps & Supplies, Ltd., shows an increase in sales for 1945 as compared with the previous year in spite of the heavy reductions in Government contracts. To cope with the demand for the new fluorescent lamps that company has purchased a factory near the lamp works. There is no lack of orders at present, but unfortunately the plant available cannot at present be fully utilized owing to shortage of labour. Export orders for the first four months of the current year amounted to one-third of the total order sheet.

Newman Industries, Ltd.—In his review of the company's activities during the past year at the annual meeting on May 31st, Mr. A. J. Newman (chairman and managing director), said that the company had been faced with the difficulties of the reconversion of departments previously engaged on the production of war equipment, and the directors believed that in view of the disruption resulting from change-overs of this nature, the maintenance of the standard of profit could be considered as a satisfactory result. The demand for the company's products far exceeded the productive capacity, and every possible step was being taken to increase output and to meet the demands, emanating from most parts of the world. This had necessitated the installation of the most modern equipment and a considerable expansion of their design and development sections. To enable them to take full advantage of the research and development work carried out, a considerable expansion of their activities had been planned, and at an early date the directors expected to place before the shareholders proposals for increasing the issued share capital.

Edmundsons Electricity Corporation, Ltd.—After providing for taxation, debenture and loan interest and debenture stock redemption, the net profit for the year ended March 31st last was £572,397, which compares with £538,065 in 1944-45. It is proposed to transfer £20,000

(same) to general reserve and to pay a final dividend of 3½ per cent (same), again making 6 per cent for the year. The carry-forward is increased from £172,877 to £201,453. Though the number of consumers connected increased during the year from 504,433 to 514,644 and the maximum demand from 612,000 kW to 627,000 kW, sales of electricity fell from 2,305 million kWh to 2,145 million kWh.

Southern Areas Electric Corporation, Ltd.—At the annual meeting Viscount Elibank, chairman, referred to the Government proposals to bring the electricity supply industry under some form of national ownership, and said that having regard to the changes which might take place in the ownership and control of their electricity supply subsidiaries, the directors had devoted attention to the development and expansion of their manufacturing subsidiaries. Mawdley's, Ltd., earned satisfactory profits before the war but during the war taxation had operated unfairly, and for an output of many times more than the pre-war rate the profits left for distribution had been very meagre. However with the cessation of E.P.T. at the end of this year they could look forward to receiving a higher return on their investment in this company in the coming years. Their investment in P.A.M., Ltd., had been similarly affected. The development of another subsidiary, Gillott Electro-Steam Cookers, Ltd., was being considerably retarded owing to the difficulties in obtaining labour and materials. They had other manufacturing proposals under consideration which might form suitable investments for any surplus funds realized in the event of new legislation causing the sale of any of their electricity supply undertakings. No increase in charges to domestic consumers would be made, unless inevitably required to meet the rising costs over which they had so little control.

The Antrim Electric Supply Co.—In the course of his speech at the annual meeting held on June 3rd Mr. R. P. Beddow (chairman and managing director), referred to the No. 8 Development Scheme which was promoted by the Electricity Board for Northern Ireland, and said that at the inquiry held in July last year, the chief criticism of the company was that it was charging higher prices for electricity than would be charged by the Board. There was a substantial difference between the price they had to pay to the Ministry of Commerce for bulk supply and the price payable by the Board. The Ministry of Commerce made a profit of £30,000 out of the supplies afforded the company, whereas the Board obtained its supplies at cost price.

Babcock & Wilcox, Ltd., held their annual meeting in London recently when Sir John Greenly (chairman) who presided, said that the change-over from war to peace production had proceeded smoothly. The state of the order book at the close of the financial year was satisfactory and since that date the volume of orders had very materially increased and steps were being taken to increase their production rate despite the difficulties of the aftermath of war.

The B.E.T. Electricity Supply Co., Ltd., reports a revenue for the year to March 1st of £81,785, as compared with £79,456 for the preceding year, and a net profit of £35,376 (against £32,425). The dividend for the year is maintained at 5 per cent, reserve receives £14,689, and £31,978 is carried forward (against £31,889 brought in).

The British Thermostat Co., Ltd., is maintaining its ordinary dividend for the year at 18½ per cent, by the final payment of 11 per cent.

The Bridgwater & District Electric Supply & Traction Co., Ltd., is again to pay a dividend of 6 per cent for the year.

Keith Blackman, Ltd., report a net profit, before tax, of £88,689 for the year ended March 31st, as compared with £135,654 in the preceding year. The ordinary dividend is maintained at 20 per cent.

The Philips' Incandescent Lamp Works Holding Co., Ltd., is to pay an ordinary dividend of 6 per cent for the years 1939-40, 1940-41 and 1941-42, and a dividend of 6 per cent on the preference shares for 1939-40 to 1944-45. No distribution on the ordinary shares is to be made for the years 1942-45.

New Companies

Dulec, Ltd.—Registered May 31st, as a company limited by guarantee without share capital. The original number of members is 25, each liable for £5 in the event of winding up. Objects: To act as nominees, agents, brokers, managers or trustees, etc. The subscribers are: F. G. Nesbitt, director of Simplex Electric Co., Ltd.; L. P. Haussauer, managing director, Aidas Electric, Ltd.; T. W. Heather, director, General Electric Co., Ltd.; O. H. Buckingham, director, Hotpoint Electric Appliance Co., Ltd.; G. Leslie Wates, chairman and managing director, Johnson & Phillips, Ltd.; D. W. Low, managing director, Duncan Low, Ltd; and R. C. Taylor, director, Santon, Ltd. Solicitors: Clifford-Turner & Co., London, E.C.4.

Tally-Ho Electric, Ltd.—Private company. Registered May 16th. Capital, £1,000. Objects: To carry on the business of manufacturers of, and dealers in, electrical goods and equipment, etc. Secretary: N. Symes. Registered office: 3, Grand Arcade, Tally-Ho Corner, North Finchley, N.

A. E. Freezer & Co., Ltd.—Private company. Registered April 27th. Capital, £500. Objects: To carry on the business of electricians, radio and electrical engineers, etc. A. E. Freezer, Denmead, New Inn Lane, Burpham, nr. Guildford, is the first director. Registered office: 9, High Street, Guildford.

Clifton Electrical Services, Ltd.—Private company. Registered April 29th. Capital, £500. Objects: To carry on the business of electricians, radio and electrical engineers, etc. Directors: C. Cooper, 109, Grosvenor Road, Rugby, and A. Warrington, 111a, Clifton Road, Rugby. Registered office: 29c, Regent Street, Rugby.

Streatham Electrical Installations, Ltd.—Private company. Registered May 1st. Capital, £1,000. Objects: To carry on the business indicated by the title. Directors: F. G. Smith and A. E. White. Solicitor: J. E. Stacpoole, 2, Clement's Inn, W.C.2.

E. L. Tappin & Son, Ltd.—Private company. Registered May 1st. Capital, £1,000. Objects: To acquire the business of an electrician carried on at Fisher Street, Lewes, as " E. L. Tappin &

Son." Directors: E. L. Tappin and Agnes L. Tappin, both of 3, Milton Terrace, Lewes. Registered office: 20, Fisher Street, Lewes.

East British Electric Co., Ltd.—Private company. Registered May 1st. Capital, £1,000. Objects: To carry on the business of electrical and general engineers, etc. Directors: F. A. Drake, 22, Dene Road, Dartford, and two others. Registered office: 164a, Strand, W.C.2.

Teledictor, Ltd.—Private company. Registered May 9th. Capital, £8,000. Objects: To carry on the business of electrical, mechanical and radio engineers, manufacturers of, and dealers in, electronic apparatus and components, etc. Directors: G. C. Shore, 9, Park Avenue, Wolverhampton, and F. H. Colton, 180, Marsh Lane, Fordhouses. Registered office: 214, Birmingham Road, Dudley.

Fensul Electric, Ltd.—Private company. Registered May 13th. Capital, £1,000. Objects: To carry on the business of electrical engineers, etc. Directors: R. A. Newman, 47, Winsham Grove, S.W.11, and two others. Registered office: 7, Hanover Square, W.1.

Hilton & Worthing, Ltd.—Private company. Registered May 13th. Capital, £2,000. Objects: To carry on the business of electrical equipment specialists, motor, radio and general engineers, etc. Directors: H. L. Hilton, 7, Moscow Road, Edgeley, Stockport, and L. J. Worthing, 6, Ashton Road, Bredbury, near Stockport. Registered office: 1, Grapes Yard, Waterloo Road, Stockport.

E. S. (Electrical) Contractors, Ltd.—Private company. Registered May 10th. Capital, £1,000. Objects: To carry on the business of electricians, engineers, etc. Directors: D. A. H. Briggs, "Araquaya," Fairlight Cove, Sussex, and three others.

Early Crops, Ltd.—Private company. Registered May 6th. Capital, £500. Objects: To carry on the business of designers and manufacturers of electrical and other appliances for assisting seed germination and plant growth. A. Goodman, 84, Ladbrook Road, Solihull is the first director. Registered office: 102, Colmore Row, Birmingham.

C.V.P. Electrical, Ltd.—Private company. Registered May 6th. Capital, £100. Objects: To carry on the business of manufacturers of, and dealers in, electric lamps, fittings and accessories, etc. Directors: C. V. P. Gilbert and Kathleen C. Turnbull, both of 51, Glenthorne Avenue, Croydon. Registered office: 116, High Street, Ryde, I.O.W.

S. B. Galpin, Ltd.—Private company. Registered May 3rd. Capital, £2,000. Objects: To carry on the business of electrical, wireless and general engineers, etc. Directors: S. B. Galpin (permanent), 8, Newland Drive, Scunthorpe, and three others. Registered office: 4a, Allenby Street, Scunthorpe.

Wilson Webb (Electrics), Ltd.—Private company. Registered May 2nd. Capital, £500. Objects: To carry on the business of electrical engineers and contractors, etc. Directors: E. W. Webb, 3, Sunmead Road, Sunbury-on-Thames, and two others. Solicitors: Dale & Newbery, Feltham, Middlesex.

Home Aids, Ltd.—Private company. Registered May 9th. Capital, £1,000. Objects: To acquire the business of a dealer in electrical domestic appliances carried on by W. Paul at 24, Holt Street, Wrexham. Directors: W. Paul, 107, Loxon Street, Wrexham; and H. S. Morton, Fairmount, Minerva, nr. Wrexham.

Cooper-Gonshaw & Co., Ltd.—Private company. Registered May 9th. Capital, £1,000. Objects: To carry on the business of manufacturers of, and dealers in, electrical and radio apparatus, etc. Directors: H. F. Cooper, 61, Trinity Court, W.C.1; and A. Gonshaw, 85, Kenton Court, W.8. Registered office: 3-5, Maddox Street, W.1.

Yarworth Electric Panel Co., Ltd.—Private company. Registered May 7th. Capital, £1,000. Objects: To carry on the business of heating and electrical engineers and contractors, etc. Directors: Sir Wm. Y. Jones, Kt., Glencoe, Queen's Road, Kingston Hill, Surrey, and Sir Herbert A. Walker, K.C.B., White Walls, Arundel Drive, Saltdean, Sussex. Registered office: Glencoe, Queen's Road, Kingston Hill, Surrey.

Charing Cross Electrical Installation Co., Ltd.—Private company. Registered May 7th. Capital, £4,000 Objects: To carry on business as indicated by the title. Directors: S. E. Vanstone (permanent), 61, Chandos Place, Strand, W.C.2, and two others. Registered office: 61, Chandos Place, Strand, W.C.2.

Phillips Electrical Supplies, Ltd.—Private company. Registered May 8th. Capital, £1,000. Objects: To carry on the business of electrical, mechanical, wireless, telephone, lighting, heating and general engineers, consulting wireless experts, etc. Directors: C. H. Phillips, 1561, Ashton Old Road, Manchester, 11; and E. H. Slater, 33, East Street, Audenshaw, Manchester. Secretary: J. A. Saunders. Registered office: 30, Old Street, Ashton-under-Lyne.

Striplite, Ltd.—Private company. Registered May 6th. Capital, £1,000. Objects: To carry on the business of electricians, mechanical engineers and manufacturers, etc. Subscribers: W. H. Wix, 64, Quarry Lane, Northfield, Birmingham, and F. Priestley, 28, Bodenham Road, Northfield, Birmingham, 31. Registered office: 12, Waterloo Street, Birmingham, 2.

A. Bastin & Co. (Electrical), Ltd.—Private company. Registered May 20th. Capital, £1,000. Objects: To carry on the business of wholesalers, retailers and distributors of electrical equipment, etc. Directors: H. W. Mathews, 4, Hereford Gardens, Ilford, and two others. Registered office: Bank House, 618, Lea Bridge Road, E.10.

Farrow & Pickford, Ltd.—Private company. Registered May 21st. Capital, £5,000. Objects: To carry on the business of electrical engineers and general electrical installation contractors, etc. Managing directors: A. C. Farrow, 24, Arboretum Street, Nottingham, and R. J. Pickford, 74, Thackeray's Lane, Woodthorpe, Nottingham. Registered office: Clumber Buildings, Clumber Street, Nottingham.

Liquidations

Victoria Instrument Co., Ltd.—Winding up voluntarily. A declaration of solvency has been filed.

STOCKS AND SHARES

PEACE celebrations and Whitsun holidays made little difference to the activity in Stock Exchange markets. Lively speculation in South African mining shares, and a considerable amount of speculative investment in industrial ordinary, have kept alive interest in their respective departments, while gilt-edged stocks, under the leadership of British Government securities, further improved upon their previous strength.

Radio and Television

The resumption of television broadcasts on the occasion of the Victory celebrations has had a good deal to do with the revival of interest in the companies concerned with the development of this field of enterprise. Electric & Musical Industries have risen 1s. to 35s. 6d., and Radio & Television 6d. to 10s. Scophony are also 1s. to the good at 13s. Pye deferred remain firm at 40s., but A. C. Cossor are a few pence easier at 43s. It is generally assumed that the technical development of television has not been marking time since the war halted its first tentative steps towards popularity. The commercial possibilities, and which of the interested companies are best equipped to exploit them, remain subjects of active discussion.

Price Fluctuations

Dealings began last week in the newly introduced 5s. shares of Electrical Components at 8s. 6d. The price has since strengthened to 9s. 6d. Cable & Wireless stocks hardened, on the presentation of the company's petition against nationalization to the Select Committee appointed by the Government. The preference is 2 higher at 115½; the ordinary gained 4½ on vague hopes of the usual 4 per cent dividend being increased. The petition was refused, but prices held most of the advance. Anglo-Portuguese Telephones continue strong at 31s. The Home Railway market is neglected. Southern preferred at 74½ is 1½ lower; Transport "C" weakened to 60. On the other hand, British Electric Traction deferred at 1,155 regained the previous week's loss of 10 points, and Tillings rose 1s. to 54s. 6d. In the general lists, International Combustion are 10s. higher at 9½. De la Rue ½ up at 11¾. At 6 7/16, Tube Investments are 3s. 9d. down.

Company Reports

H.T.A. shares, at 25s. cum dividend, have remained on the dull side since the announcement of the cut in the distribution from 12½ (including 2½ per cent bonus) to 10 per cent, and of the sharp setback in trading profits which was, however, retrieved by E.P.T. recoveries. The full report refers to the sale of the agricultural machinery interests, as a result of which the company receives £100,000 in cash and the balance of the consideration in shares of the purchasers. The shares are on a 4 per cent yield basis. Broadcast Relay 5s. shares have been a firm and active market, up to 27s. 6d., since the declaration of the increase in the dividend from 7 to 10 per cent. Profit-taking caused a reaction to 27s. ex dividend. The progressive character of the year's results is confirmed by the full accounts.

Shares on Offer

Shortage of shares is as pronounced in the market for electrical equipment issues as it is in most sections of the House. It may serve a purpose to indicate a few shares currently on offer in reasonably large numbers. Brush Electrical, for instance, can be bought at 12s. 1½d. to yield 4 per cent, and English Electric at 70s. 6d. to yield 2½ per cent. Amongst the relatively smaller companies, British Electric Resistance, at 8s. 6d., and British Thermostat, at 25s. 6d., are offered to give returns of £4 15s. and £3 12s. 6d. per cent respectively. Peto Scott can be bought at 12s. 6d., giving a return of 4 per cent. Crabtree Electrics are available at 51s. 3d., and Walsall Conduits at 62s. 6d. In both cases the yield is in the neighbourhood of 3½ per cent.

Siemens Results

Siemens Bros. are maintaining the dividend for 1945 at 7½ per cent. for the tenth successive year. The profits statement showed a substantial decline in the year's earnings, and was responsible for a setback in the price of the shares, which stand now at 39s. ex dividend, compared with 42s. 9d. before the declaration. At this level, the yield on the shares works out at £3 17s. per cent. The familiar problems of transition from war to peace work account for the lower profits. Coming so soon after the Johnson & Phillips report of reduced earnings, the Siemens results have given a relatively subdued appearance to this particular section of the electrical equipment market.

Johnson & Phillips Capital

Johnson & Phillips shares have rallied to some extent since the annual meeting, and are quoted at 85s. The chairman's review makes it plain that only shortage of staff and materials stands in the way of a large expansion of production. He dealt at some length with the difficulties which the company encountered with the Capital Issues Committee over the proposal to raise fresh ordinary capital for expansion purposes. The "element of bonus" in the terms on which it was intended to offer the new shares was, apparently, too generous to satisfy the Committee, although other issues have since been authorized on terms appreciably more beneficial to shareholders. The company hopes for more sympathetic consideration from the new National Investment Council when the Borrowing Bill becomes law. Meanwhile the intention remains to issue 200,000 shares as soon as the regulations permit.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

AKT.-GES. Brown, Boveri & Cie.—" Electric switching arrangements comprising two switches connected in series." 5520/44. December 21st, 1942. (Addition to 530971.) (577502.)

Aktiebolaget Surte Glasbruk.—" Electric glass furnaces." Cognate applications 7997/44 and 7998/44. April 30th, 1943. (577622.)

Automatic Telephone & Electric Co., Ltd., and T. H. Turney.—" Resonators for use in wave-guide electrical communication systems." 8311. May 3rd, 1944. (577662.)

Automatic Telephone & Electric Co., Ltd., J. W. McClew and O. A. Pearce.—" Telephone systems." 6083. April 1st, 1944. (577648.)

Bendix Aviation Corporation." Electrical connecting means." 21495/43. November 18th, 1942. (577583)

British Thomson-Houston Co., Ltd.—" Electric induction machines." 3770/44. March 1st, 1943. (577494.) " Voltage regulator circuits." 4405/44. March 13th, 1943. (577619.) " Insulation for magnetic steel and the like." 12784/44. July 7th, 1943. (577631.) " Couplings for transformers." 12463/44. July 2nd, 1943. (577630.)

Brookhirst Switchgear, Ltd., and A. G. Shreeve.—" Protective devices for electrical apparatus." 6582. April 8th, 1944. (577654.)

Champion Paper & Fibre Co.—" Electrodeposition of iron." 6766/44. February 25th, 1943. (577621.)

F. G. Clifford.—" Variable-frequency electric wave filters." 2612. February 11th, 1944. (577608.)

E. K. Cole, Ltd., and A. W. Martin.—" Push-button controlled wireless receiving sets." Cognate applications 4887/44 and 21544. March 16th, 1944. (577641.)

A. C. Cossor, Ltd., B. S. Fleming Williams and A. Allen.—" Thermionic generators for producing scanning and like voltages." 8434. May 4th, 1944. (577663.)

L. E. W. C. N. Davey.—" Electrical fuses." 3288. February 22nd, 1944. (577584.)

General Electric Co., Ltd., V. J. Francis and A. H. Willoughby.—" Combinations of h.p. mercury vapour electric discharge devices with circuit elements adapted to operate them." Cognate applications 14470/41 and 15114/41. November 10th, 1941. (577528.)

General Electric Co., Ltd., S. H. Noble, H. P. Rooksby, W. G. S. Branson and J. S. Herriott.—" Thermionic cathodes." 1021. January 19th, 1944. (577599.)

Gummers, Ltd., and A. E. Ellis.—" Thermostatic valves for controlling heating or cooling systems." 1480. January 26th, 1944. (577601.)

J. Hammond and F. F. Tarrant.—" Means for locking electric lamps in lampholders." 9791. May 20th, 1944. (577508.)

H. H. Harvey.—" Electric ceiling roses and the like." 10485. May 31st, 1944. (577522.)

A. H. Hunt, Ltd., and R. A. Grouse.—" Electrical condensers." 4799. March 15th, 1944. (577499.)

Johnson & Phillips, Ltd., and S. J. Wimsett.—" Time delay devices." 13856. August 25th, 1943. (577535.)

Landis & Gyr Soc. Anon.—" Armature construction for electric relays." 21236/43. December 21st, 1942. (577545.)

G. Hagerup Larssen.—" Electrode frame structures for electrode furnaces." 16804. October 13th, 1943. (577567.)

H. Meadows, Ltd., and W. W. Hamill.—" Thermostatic elements of and for apparatus operating by thermostatic action, and the manufacture thereof." 4459. March 10th, 1944. (577638.)

Messier Aircraft Equipment, Ltd., and C. B. V. Neilson.—" Electrical distant control." 5021. March 17th, 1944. (577643.)

Novobax, Ltd., and A. V. Sharman.—" Electrical connectors of the pin-plug and socket type." 3007. February 17th, 1944. (577612.)

Patelhold Patentverwetungs- & Elektro-Holding Akt.-Ges.—" Electric resonators." 3082/44. February 18th, 1943. (577613.)

A. F. Pearce, N. C. Barford and B. J. Mayo.—" Electron discharge devices employing hollow resonators." Cognate applications 16230/41 and 681/43. December 16th, 1941. (577530.)

L. N. Reddie (Union Minere du Haut-Katanga).—" Process for the treatment of solid materials in electrolytes." 16831. October 13th, 1943. (577568.)

Standard Telephones & Cables, Ltd.—"Spiral filaments for electron-discharge devices and the like." 1679/44. January 30th, 1943. (577602.) " Piezo-electric crystal holder of the cartridge type." 10621/44. June 8th, 1943. (577625.)

Standard Telephones & Cables, Ltd. (International Standard Electric Corporation).—" Carrier wave signalling system." 18451. November 6th, 1943. (577572.)

Standard Telephones & Cables, Ltd., C. W. Earp and G. G. Samson.—" Blind-landing arrangements." 12067. September 19th, 1941. (Addition to 577276.) (577527.)

A. H. Stevens (Gibson Electric Refrigerator Corporation).—" Absorption refrigeration systems, and control apparatus therefor." 20080. December 1st, 1943. (577544.)

H. J. C. Wells.—" Thermostatically controlled mixing valves." 9924. May 23rd, 1944. (577551.)

Westinghouse Brake & Signal Co., Ltd.—" Railway signalling systems." 17725/43. January 8th, 1943. (577570.)

Westinghouse Brake & Signal Co., Ltd., L. E. Thompson and A. Jenkins.—" Alternating electric current rectifiers of the selenium type." 3912. March 2nd, 1944. (577585.) " Alternating electric current rectifiers of the dry plate type." 3913. March 2nd, 1944. (577616.)

Amended Specification

570380. Callender's Cable & Construction Co., Ltd., and others. " High voltage electric cables."

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—July 25. Steam turbine driven feed pump unit, heaters, pipes and valves (Spec. 410; first copy £2 2s. others 10s 6d). August 10th. 30,000-kW turbo-generator and accessories (Spec. 413, price as before). City Electric Light Co., Boundary Street, Brisbane.

Beckenham.—July 1st. Borough Council. Supply and delivery of heavy-current testing equipment; high voltage d.c. testing equipment; tower wagon; cable drum and transformer carrier, and motor vehicles. (June 7th.)

Cheadle and Gatley.—June 21st. Electricity Department. One 500-kVA and three 600-kVA oil cooled transformers. (May 31st.)

Dundee.—Electric lighting installations at 24 houses; city quantity surveyor, 21, City Square.

Glasgow.—June 17th. Transport Department. Twenty trolley-bus chassis. Forms from the general manager, 46, Bath Street.

Littleborough.—June 26th. Electricity Department. 500-kVA transformer. (June 7th.)

Liverpool.—June 24th. Electric Supply Department. Transformers. (May 31st.)

Newcastle-upon-Tyne.—June 22nd. Health Committee. Four electric cabinet refrigerators for the General Hospital. Particulars from the Health Department, Town Hall.

North of Scotland.—June 24th. Hydro-Electric Board. Transformers. (May 31st.)

June 29th. Construction of Clunie power station, Tummel-Garry project. Sir Alexander Gibb & Partners, 39, Northumberland Street, Edinburgh, and Queen Anne's Lodge, Westminster, London, S.W.1.

Salford.—June 22nd. Public Health Department. Electrical equipment, including motors. (June 7th.)

Sheffield.—July 5th. Electricity Department. Pipework, tanks, valves, etc., for 50,000-kW turbo-alternator and three boilers at Neepsend generating station. (June 7th.)

South Africa.—June 24th. Somerset East Municipality. Condensing plant, de-superheaters, water filter, h.v. and l.v. switchgear, transformers and sundries. (Notice 22/1946).

Wallasey.—June 20th. Electricity Department. Ripple control apparatus and meter testing equipment. (May 31st.)

July 1st. Borough Council. Salt-glazed stoneware ducts for twelve months. (See this issue.)

Orders Placed

Birkenhead.—Health Committee. Accepted. Three electrically heated food conveyors (£223).—A. Brown & Son.

Bolton.—Housing Committee. Accepted. Lamp fittings and brackets for sodium lighting at Breightmet Hall estate.—Revo Electric Co.

Cheltenham.—Electricity Committee. Accepted. Transformers.—British Electric Transformer Co. (three) and Bryce Electric Construction Co. (one).

Mansfield.—Electricity Committee. Accepted. 5-panel switchboard (£567).—Ferguson, Pailin. 300-kVA transformer (£368).—Brush Electrical Engineering Co.

Middlesex.—Health Committee. Accepted. Switch plugs in 100 bedrooms at Harefield hospital (£359).—A. W. Marsh, Ltd.

Newcastle-upon-Tyne.—City Council. Accepted. Electrical installations in 358 houses (£8,853).—J. & F. Lewis (Lighting & Radio),Ltd.

Northampton.—Health Committee. Accepted. X-ray plant at clinic (£2,041).—Watson & Sons.

Ossett.—Education Committee. Accepted. Electrical installations at Domestic Science School (£90).—R. Levitt.

Roxburgh.—County Council. Accepted. Electrical installations in 130 houses at Newtown and St. Boswell's (£6,568).—J. & F. Lewis (Lighting & Radio), Ltd.

Salford.—Light Heat and Power Committee. Recommended. Structural steelwork for extension of Agecroft power station (£220,310). Edward Wood & Co.

Stockton. — Town Council. Accepted. Electrification of the Bowesfield industrial site: Transformers.—C. A. Parsons. L.v. switchgear.—W. Lucy. H.v. switchgear.—A. Reyrolle. Cables.—Edison Swan.

Swindon.—Corporation. Accepted. Electrically-driven pumping plant for the new water borehole at Latton (£9,537 5s., plus £280 for special fittings).—Sulzer Bros.

Wallasey.—Electricity Committee. Accepted. Two switchboards (£363).—A Reyrolle & Co.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Ashby.—Houses (50), Westfield; T. Barker & Sons, builders, 14, Swan Street, Loughborough.

Bangor.—Houses (50), Coed Mawr estate; borough surveyor, Town Hall.

Bentley.—Houses (70), Jossey Lane (£83,464); P. P. Taylor (Doncaster), Ltd., builders, 6, South Parade.

Bethesda.—Houses (86), Coetmor, Llwynbleddyn and Gerlan; Isgoed Williams, architect, Bryn Derwen Offices, Penmaenmawr.

Billinge and Winstanley (Lancs).—Houses (38), Birchley; C. Brown, surveyor, Council Offices.

Birkenhead.—Houses (42), Mount estate (£48,140); Lloyd & Cross, Ltd.

Bolton.—Transformer house, Asia Mill, Carter Street; Wolfenden & Son, Ltd.

Bournemouth.—Houses (90), The Broadway, Castle Lane; A. E. Adams, 29, Somerley Lane.

Brighton.—Conversions at " A " block, Municipal Hospital, for nurses' bedrooms and medical staff rooms; town clerk, Town Hall.

Cardiff.—Factory, Western Avenue: Unity Structures (Wales), Ltd.

Caterham.—Houses (64), four Council estates; U.D.C. surveyor.

Chapel-en-le-Frith (Derbyshire). — Factory extensions (£250,000); Ferodo, Ltd.

Coseley.—Houses (154), Woodcross; J. C. Roper, clerk, Council House.

Coventry.—Houses (103), Charter & Canley estates (£126,630); city engineer.

Cheltenham.—Biscuit factory, Swindon Road; Alex Robb & Co.

Chester.—Restaurant, Church Street (£4,500); city engineer.
Houses (74), Circular Drive (£86,803); T. Warrington & Sons, Ltd.

Crewe.—Houses (92), Rolls Avenue, Railton Avenue and Wheelman Road; L. Reeves, architect, Municipal Buildings.

Croydon.—Erection of science block, John Ruskin Grammar School; education officer.

Dagenham.—Houses (60), Dagenham Road estate; borough engineer and surveyor.

Dearne.—Houses (76), for U.D.C.; W. H. Adams, architect, Council Offices, Bolton-upon-Dearne.

Deptford.—Houses (58), Milton Court Road, New Cross; houses (24), Knoyle Street, New Cross; and flats (48), Arica Road, Brockley; H. V. Ashley & Winton Newman, architects, 3, Verulam Buildings, Gray's Inn, W.C.1.

Derby.—Houses (20), Sinfin Lane site; A. G. Walker, acting borough architect, Council House, Corporation Street.

Derwent.—Houses (59), Heslington, Elvington, Dunnington, Wheldrake and Naburn; E. V. Hunter, architect, 9, Minster Yard, York.

Dudley.—Houses (50), Yew Tree Hill estate; Sims, Son & Cooke, Ltd.

Edinburgh.—Libraries at Sighthill and Crewe Toll; town clerk, City Chambers.

Enfield.—Ministry of Works training centre, Mollinson Avenue; Percy Bilton, Ltd.

Friern Barnet.—Houses (128) and flats (90), Colney Hatch estate; U.D.C. surveyor.

Harrogate.—Houses (76), Knaresborough Road (£81,279); W. G. Birch (Harrogate), Ltd., Springfield Avenue.

Hartismere.—Houses (24) at Brundish, Gislingham, Palgrave and Wyverstone; L. Barefoot, The Thorofare, Ipswich.

Hornsey.—Flats (24), Stroud Green Road; J. H. Melville Richards, borough engineer and surveyor, Town Hall.

Hull.—Houses (38), Foredyke Avenue; H. Rawlinson, Ltd.

Hyde.—Additions, Newton Bank Print Works; Architects' Department, Calico Printers' Association, Ltd., 89, Oxford Street, Manchester.

Kingston-upon-Thames.—Two blocks of four flats, Kings Road; A. W. Forsdike, Town Clerk.

Limehurst.—Houses (75), Cranbourne Road; A. V. M. Deane, builder, Roker Park, Audenshaw.

Ludlow.—Houses (56), for Borough Council; S. N. Shrimpton & Son, architects, Knighton, Radnorshire.

Maghull.—Houses (37), Hall Lane; Woodend Building Co., Ltd., builders, Rice Lane, Walton, Liverpool.

Manchester.—Additions, clothing factory, Lever Street, for Morcosia Coats, Ltd.; Drury & Gomersall, architects, 11, Imperial Buildings, Oxford Road.

Mannings Heath (Sussex).—Houses (20), for the Mannings Heath Housing Society (1944), Ltd.; G. Coles, architect, 40, Craven Street, London, W.C.2.

Mansfield.—Occupational therapy block at Berry Hill Centre; Miners' Welfare Commission.

Nottingham.—Houses (228) and four shops, Western Boulevard site; H. Kellett Ablett, city housing architect, Guildhall.

Oswestry.—Houses (110), Shrewsbury Road; S. Fox-Davies, architect, Memorial Hall.

Penrith.—Houses (80), Scaws estate; F. E. B. Blanc, architect, 19, King Street.

Poole.—Houses (112), Ringwood Road, Parkstone; J. R. Barron, borough engineer, Municipal Buildings.

Prestbury (Glos.).—Four blocks of maisonettes and 10 houses, New Barn Lane; C. Webber.

Rickmansworth.—Houses (66), for U.D.C. (£75,476); E. S. Gates, builder, Little Chalfont, Amersham.

Rochdale.—Dairy depot, Crawford Street; United Co-operative Dairies, Ltd., 2, Broadway, Failsworth.

Rotherham.—Houses (250), East Herringthorpe estate (£268,222); borough engineer.

Sheffield.—Houses (46), Parson Cross estate (£65,965); M. J. Gleeson, Ltd.

Southall.—Houses (36), Hyde estate (£45,344); J. Ridley & Sons.

South Kesteven.—Houses (30), Deeping St. James, for R.D.C.; W. E. Norman Webster, architect, 1a and 2a, Station Street, Spalding, Lincs.

Stockport.—Primary school, Broadstone Hall Road; borough engineer.

Thornaby.—Houses (50), Lanehouse Road; Coultas & Shaw, Ltd., builders, Acklam Road.

Tintwhistle.—Houses (32) at Speedwell for the R.D.C.; M. Osbaldeston, clerk.

Trowbridge. — Houses (48), Shails Lane (£58,313); E. J. G. Morgan, Ltd., builders, Oxford Road, New Denham, Uxbridge.

Wallasey.—Houses (42), Pasture Crescent (£45,686); Wm. Thornton & Sons, Ltd., Liverpool.

Wem (Salop).—Houses (50), Lowe Hill Road site; Hind & Brown, Council's architects, 22, Glebe Street, Stoke-on-Trent.

West Bridgford.—Houses (56), Valley Road (£72,277); W. & J. Simons, Ltd., builders.

Worksop.—Houses (32), Rotherham Baulk, Carlton (£37,080), for R.D.C.; J. Brown (Retford), Ltd., builders, Retford.

York.—Houses (146), Acomb Hall estate (£158,939); Ainsty Building Estates, Ltd.